FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

JANUARY–FEBRUARY, 1971

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

206

VARIETIES OF APPLES FOR MASSACHUSETTS

J.F. Anderson
Department of Plant and Soil Sciences

Variety	Recommended for	Harvesting Season
Julyred	T	Late July to early Aug.
Quinte	T	Late July to early Aug.
Puritan	C & H	Mid-August
Early McIntosh	C & H	Mid to late August
Tydeman's Early	T	Late Aug. to early Sept.
Paulared	T	Late Aug. to early Sept.
Niagara	T	Early September
McIntosh	C	Mid-September
Macoun	C & H	Late September
Spartan	C & H	Late September
Empire	T	Late September
Cortland	C & H	Early October
Delicious	C & H	Early to mid-October
Golden Delicious	C & H	Mid-October
Idared	C & H	Mid-October
Spencer	C & H	Mid-October
Mutsu	T	Mid-October
Jerseyred	T	Mid-October

T = Trial H = Home garden
C = Commercial - Varieties so marked are not necessarily equally adapted to all parts of the state.

Variety Notes

Julyred

This New Jersey introduction was harvested during the first week of August at Horticultural Research Center. The fruits are of medium size, medium red and have a bright, smooth finish. The eating quality was very good for an apple of this season. The handling and keeping qualities are very good. Julyred appears to be very promising.

Quinte

This variety has yet to fruit in our orchard. The fruit of this Canadian introduction ripens 7 to 10 days before Melba, has a yellow skin overlaid with an attractive red blush and is equal to Melba in quality. Under good growing conditions, an average of 80% of the skin is red. Quinte will probably require thinning to get good size and spot picking may be necessary.

Puritan

An attractive, early red apple. Fruit of McIntosh type, good quality for its season, though somewhat tart. The tree is hardy, and vigorous with a tendency toward biennial bearing, will pollinate McIntosh.

Early McIntosh

Fruit fairly attractive, good quality, small if not thinned. Tree of medium vigor, biennial and tends to have a poor structure.

Tydeman's Early (Tydeman's Red)

An English variety from a cross of McIntosh and Worcester Pearmain. This variety, ripening in late August, is similar to McIntosh in appearance, but is said to average larger in size. The apples have a green undercolor and are overlaid with a medium-red blush. The fruit has good quality and looks promising for the early fall trade. Tydeman's Early has a habit of growth similar to Rome.

Paulared

A recent introduction ripening with Tydeman's. The fruits of Paulared are of medium size, roundish-oblate shape and have a bright smooth finish and good red color. Our limited experience suggests that Paulared is worthy of trial.

Niagara

This introduction from New York ripens about 10 days before McIntosh. Niagara is similar to McIntosh in shape and color, but the fruit from our young trees have tended to be larger in size. The finish has been less than satisfactory the past three seasons. The fruit seems more susceptible to russeting and the dots or lenticels have tended to be larger and blurred. Reports on Niagara from other sources have been more favorable and our poor response may be due to local conditions. The quality of Niagara is very good and it has been well received by those who have tried it here at the University.

McIntosh

Fruit is attractive and has excellent quality but bruises easily. Tree is vigorous, hardy, annual and productive. Rogers McIntosh or an equally good red strain is preferred.

Macoun

Fruit is of excellent quality, attractive and a dark red color. The tree has poor structure, is biennial and requires thinning to maintain good fruit size.

Spartan

Fruit has good color and quality, but has a tendency to small size. Tree is vigorous and of good structure, annual will pollinate McIntosh.

Empire

A very promising introduction from the New York Agricultural Experiment Station at Geneva. Empire, resulting from a McIntosh and Delicious cross, was introduced in 1966. The fruit ripens about 2 weeks later than McIntosh. This very attractive apple has a solid red color, medium size and very good dessert quality. The fruit hangs well on the tree. Empire is said to be annual, productive and a good keeper. We have had only two year's experience with this variety but it appears to be most promising.

Cortland

Fruit is attractive, of good quality, and is excellent for salads as the flesh does not discolor, very susceptible to storage scald. Tree is hardy, productive and annual. An excellent pollinizer for McIntosh.

Delicious

Fruit of excellent quality, but susceptible to watercore and internal breakdown. Tree is of medium vigor, often biennial and may require thinning. A good pollinizer, Richared or an equally good red strain is preferred. Spur-types are now available.

Golden Delicious

Fruit of excellent quality, yellow, attractive where well grown. Fruit is subject to russeting. Tree is of medium vigor, biennial and requires thinning to obtain satisfactory size, color and quality. "Russet-free" and spur-type strains are now available for trial.

Idared

An attractive, bright red, winter apple of good quality and size. Suitable for both dessert and cooking. Tree is productive and annual.

Spencer

Fruit is attractive, bright red and has very good quality. Suitable for dessert and pie. Tree is hardy, productive and annual.

Mutsu

A Golden Delicious type that is less susceptible to fruit russeting and storage shrivel. Tree is vigorous and productive. Mutsu pollen is triploid and not viable. Fruit size may be too large and susceptibility to Psuedomonas blight has been noted.

Jerseyred

A late Rome type apple from the New Jersey Agricultural Experiment Station. Fruit is large, well-colored, and of better quality than Rome. Jerseyred produces triploid pollen and is not suitable as a pollinator.

****

PLUM VARIETIES

J.F. Anderson
Department of Plant and Soil Sciences

An interest in plum varieties has been expressed by an increasing number of growers, especially those operating roadside stands. The following comments are on some of the varieties that have fruited at our Amherst and/or Belchertown orchards. All of these var-

ieties ripen before the McIntosh harvest begins. For a more complete listing of the plum varieties recommended for Massachusetts, you should refer to Special Circular 212-H, 1967.

Burmosa (Japanese)
The tree is small in size, medium in vigor and tends toward biennial production. The fruit is yellow with a bright red blush, becoming completely overlaid with red, attractive, medium to large in size, freestone and good in flavor. Burmosa ripens in late July.

Formosa (Japanese)
The tree is large, vigorous and moderately productive. The fruit is large, attractive and the yellow color tends to become completely overlaid with red as the fruit ripens. The flavor is very good and the fruit holds very well in storage. Formosa is picked in early August.

Shiro (Japanese)
The tree is medium in size and vigor. Shiro tends to overset and thinning may be necessary to maintain good fruit size and annual production. The fruit has a very attractive, bright yellow color, is of medium-small size and good flavor. Shiro ripens in mid-August.

Santa Rosa (Japanese)
The tree is large and vigorous, but has been a poor producer in the Amherst orchard. The trees at the Horticultural Research Center have not yet fruited. The fruit is large, reddish-purple and good in flavor. The fruit keeps and ships well. Santa Rosa ripens in mid-August.

Yakima (European)
The tree is large, vigorous, upright and moderately productive. The fruits are large, prune-shaped, reddish-purple, freestone and of good quality. Yakima ripens in late August.

Howard Miracle (Japanese)
A large, attractive, high quality Japanese plum. The fruit is golden yellow with a light red blush. The firm-fleshed, freestone was picked in late August. Production was very good this year. The flavor of this variety is not typical of a plum and might be objectionable to some.

Ozark Premier (Japanese)
A large, attractive plum with a medium-red overcolor and firm, yellow flesh. The quality of the fruit is very good. The tree is vigorous and appears to be productive. The fruit is ready in late August.

Mohawk (European)
This variety, along with Oneida and Iroquois, was named by the Geneva Experiment Station in 1966. Mohawk is an attractive blue prune, ripening in late August. The size is medium to large and the quality very good. Production has been moderate. Mohawk is said to be self-unfruitful.

Iroquois (European)
An attractive blue prune that ripens in early September about a week before Stanley. The fruit is of medium size, longer than Stanley and of good quality. The tree is productive. There was some splitting of the fruit when the trees first came into bearing. Iroquois is said to be self-fruitful.

Red Reine Claude (Reine Red) - European
A red bud sport of the Reine Claude or Green Gage plum, ripening in early September. The fruits have an attractive red overcolor, are of medium to small size. The flesh is tender, juicy and of very high quality.

New York 981 (European)
A large reddish-blue plum of very high quality. The fruit ripens in early September. The tree has been a good producer in our Amherst orchard.

****

CHANGES IN INSECTICIDE RECOMMENDATIONS FOR 1971

Gary Jensen
Department of Entomology

Although Dieldrin and BHC (so-called "hard" pesticides) were registered for usage on apples and pears in the Commonwealth of Massachusetts during 1970, they were purposely omitted from the Massachusetts Spray Charts published by the University in cooperation with the Cooperative Extension Service, County Extension Services and the United States Department of Agriculture.

Lead arsenate, another persistent material, was also omitted from the charts although its usage on apples and pears was perfectly legitimate.

These steps were taken in an effort to curtail any possibilities of contamination of the environment by persistent pesticides, in advance of any regulations which may or may not restrict their future usage on these commodities. Other less persistent chemicals (and often less effective as well) have been inserted in place of those just mentioned.

Growers are continuously encouraged to use proper methods of application and disposal of pesticides to facilitate non-contamination of the environment with these materials.

An attempt to recommend narrow spectrum materials, and those which are at least toxic to beneficial species, will be made in future recommendations when feasible.

****

GLYODIN NOT AVAILABLE TO FRUIT GROWERS FOR 1971 AND PHENYL MERCURY ACETATE IS A BIT SHAKY

C.J. Gilgut
Department of Plant Pathology

Glyodin is a good scab-control fungicide and it controls other apple diseases too. The manufacturer has stopped making it because there is not enough sold to make it pay. Our understanding is that arrangements have been made with another manufacturer to produce enough glyodin to make Glyodex - a combination of glyodin and dodine - for 1971.

Phenyl mercury acetate is the best material for "kick-back" against apple scab that is available to growers. The way it is used is safe and it does not cause environmental pollution. It is sprayed on trees in emergencies, once or twice a year, before fruit is formed so that there is no residue on fruit. On the trees, it has a short residual life and in the soil, it is quickly immobilized so that it does not leach out to cause water pollution. Wildlife-feeding studies indicate rapid elimination and no concentration in muscle tissues. In case of accidental ingestion, it is rapidly eliminated from the body and the symptoms are curable.

Although phenyl mercury acetate is still registered by the USDA and the State Pesticide Board and is allowed for use on apples, as this is being written, the situation may change because mercury has had some bad publicity in the press during the past year or so. For this reason, and because it is considered prudent not to provide instant ecologists and antipesticide crusaders ammunition with which to continue attacks on pesticides, phenyl mercury acetate for apple scab control will not be included in apple pest control programs in Extension program in Massachusetts in 1971.

****

COLD INJURY TO PEACH TREES

William J. Bramlage
Department of Plant and Soil Sciences

(Editor's Note: This article was first published in the January-February, 1967 issue of Fruit Notes, based on a talk presented in New Jersey by Dr. E.F. Savage. Recently, a paper was published (Jour. Amer. Soc. Hort. Sci. 95:286-292) presenting the data on which Dr. Savage's talk was based. This research is quite intriguing and since no new data were presented, we are republishing this article for your information.)

Growers in the Coastal Plain area of Georgia have always been plagued by the very short life of their peach orchards---the average life of trees there is only 8 years. Many years of investigations showed that nutrition, diseases, and nematodes all may play a part in this problem, but the basic cause was not uncovered. However, recent findings seem to have pin-pointed this basic cause: it appears to be cold injury.

This injury usually occurs in early spring when the trees have become physiologically active, not during the winter when the trees are in their rest period. And it does not have to get very cold to produce injury; in 1949, a low temperature of 26° F. killed thousands of trees. The injury occurs primarily in the cambium (dividing) and phloem (food-conducting) tissues, and appears as a discoloration in the cambium extending from the ground level upward to 2-3 inches above the crotch along the scaffold limbs. After a few warm days, a characteristic "sour sap" odor resulting from the fermentation of the injured tissues occurs.

Results of studies by Dr. Savage's group at Experiment, Georgia, are rather startling. They have found that tree trunk temperature is higher in winter than in summer. This happens because in the winter solar radiation penetrates directly into the bark, and is absorbed by the dark-colored bark. Such large amounts of heat are accumulated that trunk temperature may rise 40°F. or more <u>above air temperature</u>. This situation does not occur in the summer because (1) the trunk is shaded by leaves and (2) cool water is being drawn through the trunk, from the soil to the leaves.

Of course, these high trunk temperatures persist only during daylight hours. At night, trunk temperatures fall to near air temperature. Thus, if a bright, sunny day is followed by a cold night, violent fluctuations of trunk temperature can occur. For example, Savage described a sunny, 66°F. day followed by a 4°F. night in 1963--the tree trunks were exposed to about 100°F. temperature drop in 10 hours. If the tissues are dormant, they may survive such a shock, but if they are physiologically active, severe injury and subsequent death of the tree can be expected.

An important factor in this situation is trunk size. The larger the trunk, the more heat will be absorbed and retained during solar irradiation. Seldom does injury occur to less-than-4-year-old trees, simply because they do not absorb as much heat and therefore experience such violent temperature fluctuations. This also is why most of the injury occurs in the trunk rather than in scaffold branches.

Another important factor is wind. On a bright, sunny day, heat will not accumulate in the trunk if a mild breeze is blowing, so wind can be a protective influence. But at night, a wind will significantly lower the temperature of the trunk on the windward side, and therefore may be a damaging influence.

It should be clear, then , that cold injury is the result of a combination of environmental and physiological factors. Work is now under way in Georgia to find an economical way to protect the trees from this injury. It has been found that wrapping trunks with aluminum foil backed with fiberglass is effective protection but it is not economical.

The type of injury that occurs in Georgia may be quite rare or even unknown in New England. It certainly is not the problem here that it is in Georgia. Nevertheless, the findings of Dr. Savage's group should help us to understand why trees respond to their environment in the way that they do.

Do these results obtained in Georgia have _any_ application to us in New England? They do indeed! Eggert reported from New Hampshire some years ago (_Proc. Amer. Soc. Hort. Sci_. 45:33-36) that between December, 1943, and March, 1944, peach tree trunks reached 60°F. or higher on 18 different days, and reached 80° or higher on 5 different days. On most of these days, air temperature was at or below 32°F. He found that trunks of apple trees, on the other hand, underwent far less severe temperature fluctuations, and this difference he attributed to differences in smoothness, thickness, color, and texture of bark.

How much can be done practically to reduce cold injury to trees is highly debatable. Nevertheless, the findings of Dr. Savage's group should help us to understand why trees respond to their environment in the way that they do, and should help us to evaluate problems that may develop.

****

IMPROVE YOUNG ORCHARDS WITH LIMB SPREADERS

Duane W. Greene
Department of Plant and Soil Sciences

The shape of an apple tree may be improved by favorably positioning limbs around the tree. At the 13th Annual Meeting of the Dwarf Fruit Tree Association, Dr. Don Heinicke of the U.S.D.A, Wenatchee, Washington, demonstrated a tree training system now used extensively in the State of Washington. This system is based on the use of a new commercially produced limb spreader. Briefly, these spreaders are made of lengths of 1 x 1 inch wood ranging between 10 and 20 inches in length. A nail is inserted in each end to securely keep the spreader in the tree.

Not only are crotch angles improved but branches can be positioned to distribute vigor and improve light penetration. The im-

portance of light penetration is stressed. Spur-type trees are made to look like standards and spur development is hastened in standard trees. It has been reported that spread trees have more fruit buds, both initiated and set. This may be of particular interest to growers who have a difficult time getting young 'Red Delicious' trees to set fruit.

Limb spreading is not a particularly time-consuming process. In a pruning demonstration in 2 and 3-year-old orchards, Dr. Heinicke was able to both spread and prune a tree in 3 or 4 minutes. The potential benefits gained from limb spreading may make a small investment of time well worth the effort.

****

POMOLOGICAL PARAGRAPHS

Apple trees tolerant to terbacil: Tree fruits must have sufficient tolerance to herbicides to withstand the chance of excessive application. Furthermore, the soil types and conditions under which herbicides are applied are extremely variable, making a degree of tolerance essential. Recent work by A.R. Putnam and H.C. Price, Michigan State University (Jour. Amer. Soc. Hort. Sci., Volume 94, No. 6, 1969) showed that 6-year-old apple trees of 3 varieties tolerated 3 successive annual applications of terbacil at 4 times the rate required for weed control. It would appear, therefore, that the magnitude of tolerance is sufficient for safe use under a wide variety of conditions in our Massachusetts apple orchards.

When using terbacil, however, it should be remembered that this herbicide is labeled only for apple and peach orchards which have been established 3 or more years.

Pruning severity as related to scion/rootstock combinations: Richard Norton, Fruit Agent in Western New York State, recently reported in the April, 1970, Supplement of the New York State Horticultural Society Newsletter that he can prune apple trees of EM VII more severely and keep them fruitful than those on MM 106. Furthermore, he found that Idared and Golden Delicious will continue to bear when severely pruned, but 20 Ounce and Red Delicious may stop fruiting.

****

FACTORS INFLUENCING THE SHAPE OF APPLES

William J. Lord
Department of Plant and Soil Sciences

Shape of apples is an important contribution to attractiveness. It is known to be influenced by several factors, one of which is distribution of seeds in the fruits. As most growers know, apples with small numbers of seeds are frequently lop-sided with the less fleshy side being the one lacking seeds. Climate also can affect shape. In Massachusetts, J.K. Shaw in 1914 (A study of variation in apples. Massachusetts Agr. Exp. Sta. Bul. 149), reported on relationship between shape of Ben Davis and Baldwin apples and the temperature following bloom; the cooler the temperature, the more elongated the apple. He concluded that during the post-bloom period, temperature variations between the 6th and 16th day after full bloom fitted the observed variations in shape more closely than during any other period.

In 1963, M.N. Westwood and L.T. Blaney in Oregon (Non-climatic factors affecting the shape of apple fruits. Nature 200:802-803.) reported effects of several non-climatic factors on shape of apples. In a study with Red Delicious, rootstocks were found to have a significant effect with fruit on seedling roots, EM I, or EM XVI being more elongated than those from trees on EM VI, EM VII or EM IX. With Golden Delicious, both crop load and fruit location in the cluster affected the shape of fruits. Those from trees with a light crop (whether the result of heavy thinning or a light bloom) were longer than fruits from trees with a heavy crop. The "King" fruits were longer than side-bloom fruits.

A possible genetic effect on fruit shape also was studied by Westwood and Blaney using three strains of Red Delicious. They found that fruit shape differed significantly with strain, common Delicious fruits being flatter than Starking and Starkrimson fruits.

~~Recently,~~ M.W. Williams and E.A. Stahly in Washington (Effect of cytokinins and gibberellins on shape of 'Delicious' apple fruits. Jour. Amer. Soc. Hort. Sci. 94 (No. 1):17-19), suggested that the influence of temperature, crop size, and location in the blossom cluster on fruit shape are possibly related to their effects on growth regulators in the developing fruits. They showed that an application after full bloom of two kinds of growth regulators, cytokinins and gibberellins, alone and in combination increased fruit length. Cytokinin-treated fruits were longer than normal with prominent, well-developed calyx lobes, whereas those treated with gibberellin were merely longer.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Postage and Fees Paid
United States Department of Agriculture

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences

Cooperative Extension Service

College of Agriculture

University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

MARCH–APRIL 1971

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

USE CAUTION IN STORING NURSERY STOCK

William J. Bramlage
Department of Plant and Soil Sciences

Fruit growers sometimes receive trees too early for planting in the field. This is especially true if the trees have been ordered from southern nurseries. In order to prolong dormancy of the trees, it is convenient (and sometimes recommended) to place the trees in cold storage rooms where apples have been stored, or perhaps still are being stored.

There is danger in this practice. One of the gases produced by fruit during storage is ethylene, a very potent plant growth regulator. One of the effects of ethylene is the breaking of dormancy in many kinds of plant materials. It is possible that residual ethylene in the storage atmosphere might break dormancy of the nursery stock and cause injury to the trees.

A recent article from England reminded us of the reality of this danger. Howard and Banwell (Commercial Grower, 14 Nov, 1969), from the East Malling Experiment Station, reported losses of apple and pear trees that had been temporarily stored in empty or nearly empty apple storages. When the trees were removed from storage they showed growths of soft, white callus tissue around buds and at the bases and tips of lateral shoots, as well as callus-filled cracks in the stem especially near the tip. When the trees were planted they either died or else parts of them failed to grow, depending on the extent of injury. Pear trees were especially sensitive to this injury. Subsequent tests proved that the injury was indeed due to ethylene in the atmosphere.

Loss of nursery stock that was held temporarily in fruit storages has been observed before. In 1950, peach trees planted in the college orchard in Amherst failed to grow after temporary storage in a fruit room. Ethylene was suspected as the cause, and in 1952, a report from Geneva, New York supported this suspicion.

Curtis and Rodney (1952. Proc. Amer. Soc. Hort. Sci. 60:104-108) observed injury on pear trees held in cold storage. The injury they reported in 1952, was similar to that just reported from England: breaks in the twigs that were filled with soft, white callus tissue. When the twigs dried out the injured tissue shrunk and died. Laboratory tests proved that ethylene caused this injury, which resulted in death of many twigs upon removal from storage.

The tests in Geneva emphasized the potential danger to trees from residual ethylene, for as little as 1 ppm of ethylene caused injury. Temperature of the storage was an important factor in this study. At 1 - 10 ppm ethylene, no breaks developed in the bark during the first 3 weeks at 35°F. and subsequent twig growth was not impaired, but at 45°F. breaks developed during the first week of storage with as little as 1 ppm of ethylene in the atmosphere.

At 55° F., the rate of injury was much greater still. Other kinds of nursery stock (apples, plums, and cherries) were compared with pear trees for susceptibility to injury, and none was as susceptible as pears. However, most showed some injury from the ethylene storage.

We do not know how widespread is the practice of temporarily placing trees in fruit storages, but we suspect that it is done fairly commonly, especially in years when the soil warms slowly. We also suspect that injury has occurred without storage being recognized as the cause. Fruit growers should become aware of this danger and use caution when storing trees.

Trees should not be put into fruit storages unless storage is really necessary. If it is necessary, then the following precautions should be taken.

1. Do not put the trees in a room still containing fruit.
2. Before using an empty storage room, allow it to air out so that any accumulation of ethylene can be dissipated. (As little as 1 ppm can cause damage.)
3. Maintain a low temperature (near 32°F.) in the storage to minimize the danger of injury.
4. Do not allow the trees to remain in the storage any longer than is necessary.
5. Examine the trees at the time they are removed from storage. Look for white, feathery growth protruding around buds, at the base or tip of laterals, or around cuts; or for cracks in the stem (especially near the tip) that may be filled with soft, pasty growth. If these symptoms are observed, injury has occurred and poor growth and tree mortality can be expected.
6. Do not hold pear trees in a fruit storage unless it is absolutely essential, for pear trees are extremely sensitive to ethylene injury.

****

POMOLOGICAL PARAGRAPH

Name and Addresses Wanted: County Extension Offices, the Massachusetts Department of Agriculture and the Extension Pomologist at the University of Massachusetts receive frequent inquiries from the public concerning names and addresses of growers that specialize in "Gift Packages" and/or "Pick-Your-Own" method of harvesting fruits. If you sell gift packages or let the public pick their own fruit, send us a note so that a list can be prepared to help answer future inquiries.

****

MINERAL NUTRITION OF APPLE TREE INFLUENCED BY HERBICIDE

Mack Drake, John H. Baker, W.J. Lord and J.F. Anderson
Department of Plant and Soil Sciences

A block of 20-year-old Delicious apple trees is being used in a study of the effects of levels of nitrogen and potassium on fruit yield, color, and storage quality. These trees are surrounded by a vigorous sod cover consisting of orchardgrass, Kentucky bluegrass, timothy, witchgrass, Ladino and White clover. In 1967, the leaf nitrogen was 2.16, 2.20, and 2.27%, and in 1968, 2.23, 2.29, and 2.40%, respectively, for low, medium, and high nitrogen treatments (Table 1).

During the winter of 1967-68, dichlobenil (Casoron) was broadcast under the trees and extending a little beyond the drip line at the recommended rate (100-150 lbs/A 4% granular). During the summer, all grasses and clovers appeared to make their usual vigorous growth. The dichlobenil application was repeated during the winter 1968-69. A growth of grasses and clovers in the treated areas was retarded during the summer of 1969 and some plants were killed. There were no visual signs of leaf injury on the trees. During the winter 1969-70, the dichlobenil application was repeated (the third annual application).

By mid-May 1970, both grasses and clovers were severely injured or were killed except in the areas beyond the tree line where dichlobenil had not been applied. Foliage was a deeper green and growth was unusually vigorous even on the low nitrogen trees by mid-July 1970. In late July, many of the leaves on terminal growth showed marginal yellowing ("halo") which is the distinguishing symptom of dichlobenil injury. Growth continued to be vigorous with dense shoot growth ranging from 15 to 20 inches.

Discussion:

It appears that in this orchard the dichlobenil application was ineffective in the first year and only partially effective in the second. However, the third application in 1970 produced the undesirable effect of apple leaf injury in addition to killing the grass-clover sod. This injury to apple leaves and killing of the sod may be the result of the accumulative effects of dichlobenil applied 3 consecutive years.

Grass and clover plants in the sod compete with the apple tree for water and mineral nutrients such as Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, Sulfur, and the micronutrients, Zinc, Copper, Manganese, Boron, etc. Severe stunting of these grass and clover species reduced this competition for nutrients and water. Killing these grasses and clover not only eliminates competition for mineral nutrients, but as the sod decomposes, additional mineral nutrients are released and made available to the apple tree roots.

Effects of dichlobenil stunting or killing the grass-clover sod are indicated by leaf nitrogen values in Table 1. By 1967, the application of different rates of fertilizer nitrogen had produced a spread in leaf nitrogen that continued in 1968, but had disappeared in 1969. We believe the amount of stunting and killing of grasses and clovers in the early summer of 1969 was much greater than visual appearance indicated. This 1969 stunting and killing not only reduced grass-clover competition for available nitrogen, but death of plants increased the available nitrogen, especially as reflected at the lowest nitrogen treatment, 2.23 to 2.40% N. In 1970, all trees increased leaf nitrogen from about 2.42 to 2.57% N, and produced a large increase in both numbers of shoots and in shoot length. Whether or not dichlobenil influenced the nitrogen metabolism of these trees is not known. This possibility is under study.

TABLE 1

LEAF NITROGEN

	1964[1]	1965	1967	1968	1969	1970
Low Nitrogen	1.88	1.80	2.16	2.23	2.40	2.57
Medium Nitrogen	2.05	1.80	2.20	2.29	2.44	2.59
High Nitrogen	2.04	2.19	2.27	2.40	2.42	2.55

[1]Prior to application of treatments.

Conclusions:

1. Continued annual applications of dichlobenil or similar herbicides may injure the tree.

2. Use of herbicides that stunt the grass-clover sod will reduce grass-sod mineral nutrient competition with the apple tree roots.

3. Use of herbicides that kill the grass-clover sod will result in a release of mineral nutrients in the year sod is killed.

4. Unless the sod is re-established, loss of mineral nutrients by leaching will require careful re-evaluation of the mineral fertilizer program and will probably require an increase in fertilizer application.

****

EAST MALLING 26 ROOTSTOCK

A rootstock in which fruit growers now are showing interest is East Malling 26. Since we have had no experience with this stock at our Horticultural Research Center in Belchertown, Massachusetts, the information from Michigan State presented below should be of interest. The information was prepared by Dr. R.F. Carlson, Michigan State University, and appeared in Compact Fruit Tree, Volume 3, No. 13, October, 1970.

EAST MALLING 26 -- PROGRESS AND PERFORMANCE

East Malling 26 (EM 26) is a new rootstock as far as commercial production in North America is concerned. Very little yield data are available on the performance in relation to other rootstocks. The size control capabilities of this rootstock is well known. However, the compatibility with various commercial varieties and strains of varieties has not been completely studied and tested.

Progress made - A great number of trees have been propagated and planted in both experimental and in commercial orchards using EM 26. Most of these trees are rather young and not many are in production at this time. It will take several years before actual production records will be available at research stations and in commercail trials.

Performance - To date, no serious faults have shown up with this rootstock and it is anticipated that it will be a rootstock which will fill an important place in controlling tree size in commercial orchards. This rootstock is an improvement over East Malling IX in that it has somewhat better anchorage, it is slightly more vigorous, and it is precocious. EM 26 has an advantage in being more compatible with 'Red Delicious' and spur types of this variety than EM IX. However, not all of the 'Red Delicious' strains and spur types have been tested in experimental or commercial plantings. It is suspected that there will be a difference in response from the different combinations of the 'Red Delicious' gamut.

Improvement - EM 26 is better than EM IX with 'Red Delicious', mainly because it grows better and does not show the severe measle condition often found with 'Red Delicious' on EM IX. Due to its added vigor, EM 26 will be an improvement over EM IX expecially for some varieties which do not perform as well on other rootstocks. Both EM IX and EM 26 will be useful in certain scion/rootstock combinations and in different tree spacing systems.

Characteristics - EM IX is not completely strong as far as root system is concerned, because it has brittle wood structure. EM 26 has similar characteristics of being brittle in wood structure and can break more easily than some of the more vigorous rootstocks. Consequently, some trees on EM 26 will need support in the form of staking or trellising. In other words, many of the trees of certain

varieties on EM 26 will be free standing and will perhaps not need any support during the life-time of the tree. However, under certain conditions, some trees will lean or even topple over, depending on the variety, the orchard site and the soil type. The rootstock portion of EM 26 trees overgrow the scion similar to that of EM IX.

Combinations - As previously mentioned, all varieties have not been tested on this rootstock. Under certain conditions, 'Golden Delicious'/EM 26, for example, will make very small trees with this rootstock but this could be an advantage especially in high density plantings. In our test plantings, 'Red Delicious', 'McIntosh' and 'Jonathan' are doing well. However, as with other rootstocks there are certain varietal responses that show up in the rootstock and vice versa.

Site, Soil - The orchard site and the soil, being variable, will influence rootstock performance. To date, no detrimental effects from soil responses have been observed with EM 26. A heavy soil will cause more trees to lean. Recommendations are, of course, to plant only on well drained soils.

Important place - EM 26 will fill an important vaccum in the apple rootstock series, especially in high density plantings. Most trees of most varieties on this rootstock can be spaced very close together. An average of 450 trees per acre could be established without any serious crowding of trees at maturity with such varieties as 'Red Delicious', 'Golden Delicious' and 'Jonathan'. This would mean a tree spacing in the vicinity of 6 x 16, or 8 x 12 feet depending on many factors--management being prime.

Suggestion - Since all possibilities are not known about this rootstock, it is suggested that plantings be limited and that other rootstocks such as MM 106 or EM VII also be used. Tree size is manipulated by rootstock from small to large trees as follows: EM IX, EM 26, EM VII, MM 106 and MM 111. The first two require a good uniform moisture retaining soil and the latter four are adaptable to a wider variation of soil types. None will withstand a poorly drained soil. As the vigor of the variety and the rootstock increases, the spacing between trees should increase.

Selective - In selecting scion/root combinations, choose the combination that will suit the particular situation of the anticipated management and production scheme. All trees should be budded on the stock 12 to 16 inches above ground. This will provide better anchorage of trees in the orchard. Know the vigor potential of the variety and the rootstock that you select for your particular spacing system. High density plantings require more rootstock size control than do low density orchards.

****

RESEARCH FROM OTHER AREAS

William J. Lord
Department of Plant and Soil Sciences

Influence of Nutrition and Management on Peach Quality: The influence of nitrogen (N), phosphorous (P), potassium (K), magnesium (Mg), lime, pruning, irrigation and tillage upon peach quality were studied by John Reeves and George Cummings, North Carolina State University, Raleigh, and reported in Volume 95 (No. 3), of the Journal of the American Society for Horticultural Science. The information obtained should be of interest to peach growers in Massachusetts.

Fruit firmness: Several of the treatments resulted in significant changes in flesh firmness. N at the rate of 0.66 lb./tree in comparison to 0.33 lb./tree decreased firmness of non-irrigated Redhaven peaches[1]. Fruits from trees receiving 0.66 or 1.32 lb. did not differ appreciably, however, while irrigation virtually eliminated the influence of higher rates of N on firmness.

Medium and high rates of K (0.66 lb. or 1.32 lbs./tree in comparison to 0.20 lb.) increased flesh firmness of Elberta peaches[1] whereas 0.24 lb. or 0.48 lb. Mg/tree in comparison to 0.03 lb. Mg decreased firmness.

In the tillage experiment with the Loring variety[2] the treatments consisted of (a) soil plowed to normal depth; (b) soil plowed to a depth of 23 inches; (c) normal plowing with 28-inch holes bored to a depth of 4 feet at the planting site; (d) lime (0, 2000 or 4000 lb. of dolomitic/acre); and (e) P (0, 141, or 282 lbs./acre). With the exception of P, none of the treatments influenced firmness. The high increment of P increased flesh firmness.

Shelf-life: The data indicated that those treatments that increased firmness also increased shelf-life. N decreased the shelf-life of non-irrigated Redhaven peaches, but had no effect on those from irrigated trees. Shelf-life of Elberta peaches was increased by K and decreased by Mg.

Fruit color: Severity of pruning (light, medium, or severe) appeared to have greater effect on red color than did N with the poorest color on the severely pruned trees. Irrigation also tended to decrease fruit color. The authors postulated that high N, heavy pruning or irrigation could increase the amount of foliage on the trees, and that probably red color development was negatively associated with the amount of shading. Increased red color development was associated with the medium or high rates of K while medium or high Mg rates decreased red color.

---

[1] The experiment was established in 1953. Data on quality obtained in 1966.

[2] The experiment was established in 1962. Data on quality obtained in 1966.

The authors concluded that the unfavorable influence of Mg on firmness and shelf-life must be considered against the increase of yields and fruit size. Yield data (presented in another paper) indicated that the highest yields over a number of years resulted from the medium K (0.66 lb.) - high Mg (0.24 lb.) treatment. A proper balance of K and Mg apparently is essential not only for high yields but also for good quality.

****

GREEN APPLE APHID - ITS LIFE HISTORY AND CONTROL

Gary L. Jensen
Department of Entomology

Green apple aphids are found more often than any other aphid on apple foliage. Apple cultivars most seriously infested are Baldwin, Red and Golden Delicious, Cortland, Gravenstein, and Greening, but McIntosh also often serves as an important host of migrating aphids. Additional hosts of the apple aphid include pear, hawthorn, crabapple, quince, and possibly other members of the rose family.

Green apple aphids may infest terminals and water sprouts of fruit trees throughout the growing season. Since winged migratory forms of this insect appear in every generation, reinfestation and buildup to damaging numbers can occur very rapidly under favorable conditions. Relatively cool weather with an abundance of rainfall, such as occurred in the summer of 1970, favors succulent tree growth and thus provides favorable conditions for heavy infestation of green apple aphids.

Injuries to apple trees by these aphids may appear as follows. (1)Terminal leaves are stunted and distorted, and terminal growth may be crooked and shortened. (2)Fruit and leaves may become black and smutted due to the growth of sooty mold on the honeydew secreted by the aphids. (3)With severe infestations, aphids may feed on the fruit causing gnarling and dimpling of the fruit.

Several natural enemies of aphids, including small parasitic wasps, the larvae of syrphid flies and lace wing flies, and both larvae and adults of lady beetles prey upon them and thus can govern buildup of aphids. However, most modern-day insecticides used in apple orchards severely restrict these natural predators and therefore make chemical control of measures necessary. These measures may be a part of the regular summer schedule, but regardless of the spray program followed earlier in the season, growers need to watch for aphid buildup in early- and mid-summer. An understanding of the life-cycle and possible control measures should help in combatting the green apple aphid.

Life History

Wingless, egg-laying females and wingless males are produced during late September and October. After mating, overwintering eggs are deposited by the females. The shiny, oval, black eggs are indistinguishable from those of the rosy and grain aphids. They are most abundant on water sprouts and the vigorous growth terminals of both old and young trees. Soon after the fruit buds start to show green in the spring, the eggs begin to hatch, which is earlier than for the rosy aphid but later than for the grain aphid. Hatching is complete in 7-10 days and the young nymphs begin to suck sap from the new growth of leaves, stems and flower parts. The first generation nymphs develop into stem mothers in 2 to 3 weeks, about pink or slightly earlier. The stem mothers are a uniform pale green easily distinguished from the darker banded yellowish-green grain aphids and the rosy aphids.

Shortly before bloom the stem mothers, without mating, begin to produce living young. Walking about and eating simultaneously while giving birth to their young, they are small prolific aphid factories. Production of living young continues for a month or longer at the rate of 1 to 3 (maximum 10) nymphs per day. The majority of these second generation nymphs develop wings and migrate to other parts of the tree or new trees and there again produce living young--the beginnings of new colonies.

About half of the next generation and some of the later generations may develop wings, and these forms give birth to living young, all of which are females. The wingless forms which remain on the tree continue to produce living female nymphs which greatly increase the number of aphids on the original colony site. Males are produced only in the fall.

In a single season, 10 to 17 generations may develop depending on weather conditions. All generations may occur on apple trees, whereas the apple grain aphid and rosy aphids spend much of their time away from apples on alternate hosts.

Control

Spring

Insurance programs carried out in the early part of the growing season will prevent aphid buildup until late June or early July. The severity of reinfestation will then depend upon the nearness and abundance of untreated host plants in the vicinity, weather conditions, varieties, the presence of succulent water sprouts, natural enemies on nearby host plants and in the orchard, and the spray program. Early spring control of all aphids is strongly recommended.

For best aphid control, use Guthion* or ethion with oil or a formulated ethion-oil mixture at half-inch green, or Guthion* or demeton up to pink.

Summer

The summer buildup of apple aphids may become evident in June and may continue through July during favorable seasons.

Water sprouts which are difficult to spray well are susceptible to early and continuous, heavy infestations. Terminal foliage may be continously infested and reinfested inasmuch as the new foliage may be unprotected by sprays much of the time, especially that which has emerged since the latest application.

For control in the summer, include one of the following materials in a regular application--two or more treatments may be necessary: (1)Endosulfan (Thiodan*); (2)Phosphamidon (which will also control codling moth and give some suppression of mites); (3)Demeton (before leaves harden); (4)Diazinon; (5)Dimethoate; (6)Phosolone (Zolone*) (which showed good promise last year on apple aphids and also controls codling moth, curculio, apple maggots and suppresses red mites when used in a seasonal program).

Summer control measures should be undertaken prior to extensive curling of the leaves. Applications should be repeated soon enough to prevent buildup after reinfestation. Try to choose materials which give the advantage of added effectiveness against other pests.

*Trade name

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE. THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING! PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Postage and Fees Paid
United States Department of Agriculture

MR. RADIE H. BUNN FN
COLLEGE OF AGRICULTURE, RM. 211
STOCKBRIDGE HALL

01002

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

MAY—JUNE, 1971

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

PLANT YOUNG APPLE TREES RIGHT SO THEY WILL LIVE AND GROW

C.J. Gilgut
Professor of Plant Pathology

There is more to planting young apple trees than just getting the roots into the ground. They need understanding and tender love and care at planting time and afterward. The following two cases illustrate why.

Case No. 1 - One year whips on MM-106 rootstock were planted on sloping land near the top of a hill in April. Many were dead and others were dying on June 8.

When the plants were dug up, all the bark on the underground part of the stem, beginning at the soil line, was dead, foul-smelling, slimy and sloughed off to the touch. The wood beneath was discolored, black and watersoaked. All the roots were black and dead.

The trees were planted in straight-sided holes, made with a tractor-driven post-hole auger in heavy, hard, compacted clay soil. The soil out of the hole was used to fill in around the roots and stem and was hard, lumpy, and wet. The trees were planted deep - at least 8 inches of stem below the soil surface - in an effort to compensate for the poorer root system of dwarf trees. There was a deep depression around the base of the plant that caused water to run into the straight-sided hole and the water stayed in the poorly drained soil to create a waterlogged condition which kept out air which the roots and stem need.

The trees would have had a better chance of living and growing (1) if the planting hole had been dug wider and the compacted heavy soil in the bottom had been broken up so excess water would have a chance to drain out and not be trapped around the roots and stem. (2) if loamy field soil had been brought in to fill around the roots and stem instead of the hard, lumpy waterlogging clay soil that came out of the hole. The loamy field soil is more likely to drain better and less likely to waterlog. Admittedly, it takes some time and labor to bring it in but no more than it does to dig out dead trees and replant. Besides, one does not have the cost of new trees or loss of a growing season. (3) a deep well around the base of the tree may be alright in a sandy, well-drained soil in a dry season, but it is not alright in a poorly drained soil, or in a swampy location, especially in a wet season. It is better to have the soil around the base of the tree level or even slightly mounded. If one feels there should be a well, it should be reasonably shallow.

The roots and stem which is under the ground is as much a living part of the tree as that which is above ground. And, as all

living things, they require air. The roots are not able to stand too much drying. They need a moist environment and also need some available water in the soil to take up and transport to the upper part of the plant. The stem has its own bark to keep it from drying out and does not need water next to it.

Case No. 2 - One year whips on MM-106 rootstock were planted in good well-drained loamy soil about May 1st in holes large enough to accomodate the root system. By mid-July over 360 trees were dead.

When the trees were dug up and examined, it was found that on many, the bark on the stem below ground was dead from the soil line down to the end of the stem. On many, even the roots were dead, but on others the roots, except for the 1/2 to 1 in. next to the stem, were alive and healthy. Still other trees had one or more dead patches of bark below ground girdling the stem but the stem and roots below the girdle were alive and healthy.

What happened was this. The grower, in an effort to "push" the trees to get maximum growth the first season sent his hired "help" out two weeks after planting, with instructions to apply 2 handfuls (about 1/2 lb.) of ammonium nitrate to each tree. The help were instructed to scatter it around each tree. Some of the "help" threw the fertilizer at the base of the trees and some of the fertilizer landed against the stem or close enough to it so that rains washed it into the soil against the stem. Two weeks later, one more handful of ammonium nitrate was thrown around each tree.

Two handfuls (1/2 lb.) of fertilizer applied within one foot of the stem is 7260 lbs/A. One handful is 3640 lbs/A. The total is 10,900 lbs., or over 5 tons per acre. No wonder the trees died!

The United States Department of Agriculture fertilizer recommendation for newly planted trees is 1/4 to 1/2 lb. per tree but scattered in an area within 3 feet of the trunk. Over that much area the application is 807 to 1613 lbs/A, which is quite different from 10,900 lbs/A.

Growers can avoid killing trees with fertilizer if they do not use too much and apply it right. If the trees are to be fertilized after planting, do not apply it closer than one foot to the stem - the stem does not need it and cannot use it and may be damaged. Scatter it over the area where the edge of the planting hole is. As the new roots grow near the edge of the planting hole and into the soil surrounding the planting hole, the fertilizer will wash down to the roots over a period of time in amounts that will not harm the roots.

****

SOME THOUGHTS ON WEED CONTROL IN STRAWBERRIES

Dominic A. Marini
Regional Fruit & Vegetable Spec., Southeast Region

For 1971, the materials suggested for controlling weeds in strawberry beds are Dacthal*, diphenamid, and Tenoran*. None of these materials controls every weed and none is effective for more than 5 to 6 weeks. These materials are most effective when applied to moist soil followed by about one-half inch of moisture within 3 to 4 days. Dacthal* and diphenamid should be applied before emergence of weeds, while Tenoran* may be applied either before or soon after emergence, when weeds are less than one-inch tall.

Dacthal* may be applied immediately after setting plants. It is effective for up to one month and there is no limit on the number of successive applications except that it may not be applied between bloom and harvest of the fruiting year. It is most effective for control of crabgrass and other annual grasses, purslane, chickweed and lamb's quarters. Galinsoga, smartweed and ragweed are not effectively controlled by Dacthal*. A late summer or early fall application of Dacthal* is helpful for controlling chickweed.

Diphenamid controls weeds for up to 6 weeks. In 1970 trials, it was as effective as any other material. It should not be applied until plants have become established and have started to grow. A second application should not be made within 6 months, and it should not be applied within 60 days of harvest. Some persons have reported that it may cause a temporary delay in rooting of runners, but this should not affect yields. However, it should not be used on Raritan since there are reports of severe injury to this cultivar in New Jersey.

For several years in our trials, Tenoran* appeared more effective as a pre-emergence treatment, but in 1970, post-emergence applications seemed to do a better job. Tenoran* should be used only on established plants with not more than two applications in any season and not within 60 days of harvest. As a post-emergence treatment, Tenoran* is most effective when broadleaf weeds are one inch or less tall and annual grasses are less than one-half inch tall. It is effective for controlling most broadleaf weeds including galinsoga, while it is less effective on grasses. A fall application aids in controlling chickweed and other winter annuals. Applications in the spring of the bearing year are not suggested, since there are reports of severe injury and reduced yields in New Jersey.

There are a number of different ways that growers can use these herbicides in minimize the amount of cultivation and hoeing

---
*Trade name

needed to grow a strawberry bed. Bear in mind, however, that a certain amount of cultivation is necessary to keep the soil loose and open for rooting of runners.

1. Use Dacthal* at planting, then cultivate and treat again as necessary through the season.

2. Use Dacthal* at planting, then cultivate and treat with diphenamid or Tenoran*. Cultivate and treat again with Dacthal* or Tenoran*.

3. Use Dacthal* at planting followed by Tenoran* soon after weed emergence, then cultivate and apply Tenoran*.

4. Plant, cultivate, and then apply Dacthal*, diphenamid, or Tenoran*.

5. Plant, apply Tenoran* soon after weed emergence, then cultivate and use Dacthal* or diphenamid, then Tenoran* for fall weeds.

These are a few of the ways of using the herbicides presently registered for use on strawberries. In using them, be sure to read the label and follow directions as to recommended rates, number of applications, interval between applications, and interval between application and harvest.

****

PUBLICATION AVAILABLE

Duane W. Greene
Department of Plant and Soil Sciences

A booklet describing recent experimental findings and trends in the propagation and culture of fruit trees has been published by Dr. Robert F. Carlson. There are many topics discussed that are pertinent to the problems growers face today. The characteristics, adaptability, training, support requirements and varietal responses for each of the commercially important apple rootstocks are described. General comments are provided concerning orchard planning, planting systems, tree size control and techniques to be used for future orchards. This booklet is recommended as a guide for establishing and maintaining a profitable orchard of the future. A limited number of copies of this booklet entitled Horticultural Report Number 1 (Revised February, 1971), Fruit Trees - Dwarfing and Propagation are available free of charge by writing to:

Dr. Robert F. Carlson, Room 303, Department of Horticulture,
Michigan State University, East Lansing, Michigan 48823

****

1970 EXPERIENCES WITH AV-ALARM BIRD-SCARING DEVICE

Dominic A. Marini
Regional Fruit & Vegetable Spec., Southeast Region

Av-Alarm is an electronic device that emits sounds. According to the manufacturer, these sounds either frighten or confuse or interfere with the audio communications of birds and other animals, such as deer and rabbits, thereby repelling them and preventing crop damage.

Av-Alarm is operated by either battery or electric current. An electric eye turns it on at daybreak and shuts it off at dusk. Various controls regulate the volume of sound, sound frequency, and chirp rate. It can be set to operate continuously or intermittently. At high volumes, the hearing of persons directly in line with the speaker can be impaired.

To introduce Av-Alarm in Massachusetts, a unit was loaned to us for field testing and demonstration. In cooperation with John Lanier of the Fish and Wildlife Service, an experiment was designed for testing in cultivated blueberries. The cooperation of two Plymouth County blueberry growers was obtained, whose plantings are less than 10 miles apart and have similar surroundings. One was used as a check, the other for the test. Also assisting in conducting the test were Dr. Glenn Kinney, a research psychologist with the Mitre Corporation, Bedford, Massachusetts and Neil Morton, an Extension Technical Assistant.

Beginning in early July, just as the first berries were turning blue, a count was made of all birds seen entering, leaving or in each field for one half-hour every morning. Counting began at 6 A.M. in one field and at 7 A.M. in the other. After one week, the Av-Alarm was installed and set according to the manufacturer's instructions and counting continued another two weeks. About 50% of the birds counted were robins, 40% were grackles and starlings, and the rest were bluejays, catbirds, brown thrashers, orioles and others.

Following the installation of the Av-Alarm, there was a 12% reduction in the number of birds counted in the test planting, with a corresponding increase of 36% in the check. Unfortunately, this was not good enough, since heavy depredation continued in spite of the decrease in the number of birds counted. Varying the volume, frequency, and chirp rate did not improve its effectiveness. Another problem was that the loud, piercing sound was objectable to the pickers.

Following the conclusion of the test on blueberries, Dr. Kinney installed the Av-Alarm in ripening sweet corn which was being dam-

aged by migrating blackbirds at the Waltham Field Station, University of Massachusetts. Various settings were used, but it was impossible to keep the birds out of the field.

During 1970, at least 4 other Av-Alarm units were in commercial Massachusetts blueberry fields. In checking with these growers, 3 reported that it was not effective in reducing bird damage, while one felt that it helped.

As a further check on the effectiveness of Av-Alarm, two western New York Extension Agents were contacted. One reported that he knew of 2 cherry growers who had had good results with it. The other stated that robins are not a serious problem in western New York and that the overall bird problem has not been serious the past two years.

In contacts with the dealer and manufacturer, the reasons given for failure of the Av-Alarm to prevent bird damage to blueberries and sweet corn were as follows: the wrong setting was used, the speaker was in the wrong location, the tests were started too late in the season, the setting was changed too often, it is not very effective against robins or migrating birds.

On the basis of experience in 1970, it appears that either the manufacturer must provide more specific instructions for its operation, or improvements must be made in the device to increase its effectiveness if it is to be of significant practical value.

****

WEED CONTROL EXPERIMENT INITIATED AT MAINE AGR. EXP. STATION, HIGHMOOR FARM, 1970

Herbert E. Wave
Extension Fruit Specialist
University of Maine

It has been amply demonstrated that grass and broadleaf weed control around apple trees increases the growth rate of the trees. It would seem logical to assume that yield also increases in proportion to this increased tree growth - but does it? To answer this question, long-term plots have been established in a young orchard planted in 1969, at Highmoor Farm. These plots will be treated annually, with most of the commonly-used herbicides, and growth and yield records taken. Growth and yield of herbicide-treated plots will be compared to nonchemical weed control (mowing) and no weed control (unmowed) plots.

In 1970, the herbicide plots were sprayed with a tractor-mounted boom and single nozzle which applied a 3-foot band at a dosage rate of 40 gallons per acre. A single application of each chemical or combination of chemicals was applied on May 15, except for the paraquat treatment which was applied at approximately 5-week intervals.

Growth measurements were taken in early December after growth ceased. These measurements included the average amount of new growth and trunk diameter. Results of the 1970 treatments are summarized in Table 1. All chemical treatments had significantly more new growth than either mowed or check plots. There were no significant differences among the chemical treatments or between the mowed and check plots. The average trunk diameter of trees was significantly greater in plots treated with Sinbar* at the 3 or 4 pound rate, simazine alone or paraquat alone, than in any of the other treatments. The check plots had significantly less trunk growth than plots treated with dalapon, Sinbar* at 2 pounds, the combination treatments or mowing. These results represent one year's growth from the initiation of the herbicidal treatments. Yield records will be evaluated when trees become of bearing age.

Table 1. The influence of herbicides on vegetative growth of newly established apple trees - Orchard 69, Highmoor Farm - 1970.

Treatment - (lbs. prod/a)	Growth of terminal + 3 longest laterals/tree (in.)[1]	Trunk diameter increase (in.)
Sinbar 4#*	112.8a	1.18a
Sinbar 3#*	111.4a	1.11a
Sinbar 2#*	111.4a	0.99b
Simazine 4#*	111.0a	1.00b
Sinbar 1#*+ Karmex 2#*	104.2a	1.14a
Simazine 2# + Paraquat 1 qt.	98.4a	0.90b
Paraquat 1 qt. (3 applic.)	98.2a	1.09a
Dalapon 10#	90.3a	0.93b
Mow 3X	60.7b	0.87b
Mow 2X	58.6b	0.85b
Check	47.7b	0.71c

[1] Means followed by the same letter are not significantly different by Duncan's multiple range test at the 99% level of probability.
*Trade name

****

HERBICIDES AND WINTER INJURY

Duane W. Greene
Department of Plant and Soil Sciences

Reports from Washington State, Michigan and Ontario, Canada, suggest that there is a relationship between herbicidal weed con-

trol and subsequent winter injury. The winter injury problem has been restricted exclusively to light sandy soils where the cold injury protection given by water is at a minimum. Trees grown in clay loam and cultured on a grass or a controlled grass sod generally show no signs of injury. In Washington State, some rootstock and tree vigor influences on winter injury were noted. Red Delicious trees on seedling roots were completely killed by low temperature injury, while trees on EM VII were unaffected. Excessive injury to low vigor Red Delicious trees on seedling roots was reported whereas more vigorous trees were not injured.

Stu Carpenter, Extension Specialist from Southwest Michigan, suggested that the winter injury problem on sandy soils may be controlled by:

1. Partial weed control through the use of contact herbicides with such as Paraquat.

2. A program of herbicides plus mulch.

3. Make the band sprayed in the tree row smaller.

It may be added that in Massachusetts one spray application made in early May generally allows sufficient regrowth of grass and weeds by late fall to eliminate the possibility of winter injury to the roots.

****

RESEARCH FROM OTHER AREAS

William J. Lord
Department of Plant and Soil Sciences

Concentrate Sprays for Thinning Apples: Our circular on chemical thinning of apples suggests that thinning materials be applied alone and in dilute form (IX). We suspect, however, that some growers concentrate their thinning sprays to some extent--2X to 4X--and furthermore, interest in concentrate spraying has increased drastically during the last 2 years. Therefore, the question arises about the feasibility of concentrating thinning sprays.

The principal reason why we have been hesitant to suggest concentrating thinning sprays is the increased potential for error due to errors in mixing of sprays and in calibration of spray equipment. Doubling the concentration, doubles the size of any error in thinning, the margin for error is often small. Nevertheless, there are examples of successful application of hormone sprays in concentrated applications. We know, for example, that preharvest drop-control materials are concentrated when applied by airplane, and results

have been good. In applying hormone sprays, the important factor is to apply a given number of grams of actual material per acre whether applied as dilute or as a concentrate spray. Thus, success with these materials is dependent on the accuracy of your applications.

Limited studies have been made on chemical thinning with concentrate sprays. In 1966, C.G. Forshey and M.B. Hoffman in New York, stated that practical experience has shown that thinning results are more consistent if the concentration does not exceed 2X (New York State Agr. Exp. Sta. Res. Circ. No. 4). More recently, B.L. Rogers and A.H. Thompson, in Maryland, investigated the effectiveness of concentrated thinning sprays--ranging from 3X to 33X--and reported their findings in Volume 94 (No. 1) of the Journal of the American Society for Horticultural Science. Their results are summarized below.

A four year study with Rome Beauty apple trees (1964-1967) showed that carbaryl (Sevin*) at concentrations of 1X to 33X significantly thinned this variety 3 out of 4 years. In 1966, the year of failure, the fruit set on the check trees was low and no significant thinning occurred when dilute spray was compared with carbaryl sprays delivered at 33X volume. The use of carbaryl at concentrations up to 33X generally produced fairly consistent results. In 1967, however, carbaryl at 33X thinned less than the 1X spray.

In 1-year experiments, carbaryl at 1X, 3X and 6X significantly thinned Jonathan apple trees in 1964, and NAA at 1X, 3X and 6X significantly thinned Golden Delicious in 1967. The dilute spray of NAA was more effective than the concentrated ones, however.

The studies in Maryland, therefore, indicate that apple trees can be thinned at concentrations as high as 33X. However, much more work is needed before broad recommendations can be made. Since thinning results are somewhat unpredictable, it is questionable whether growers should thin more than a small fraction of the more valuable mid- and late-season varieties with highly concentrated thinning sprays until experience has shown satisfactory results.

*Trade name

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE. THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING! PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts 01002
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

—

Official Business

Postage and Fees Paid
United States Department of Agriculture

MR. RADIE H. BUNN FN
COLLEGE OF AGRICULTURE, RM. 311
STOCKBRIDGE HALL

01002

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

JULY–AUGUST 1971

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

BLUEBERRY MAGGOT

William E. Tomlinson, Jr.
Cranberry Experiment Station, East Wareham

Increasing problems with maggoty berries have been of much concern to growers of cultivated blueberries recently. Blueberry maggot is primarily a ripe-fruit pest that attacks the crop most heavily at the peak of the picking season and after. Fruit in netted plantings is particularly vulnerable because it is often allowed to remain unpicked longer for full ripening and sizing than berries in un-netted plantings.

Blueberry maggot is a true native insect that has fed on wild blueberries for thousands of years. It also attacks huckleberries of all kinds and possibly other wild small-berried plants. Complicating this host picture is the fact that the apple maggot is identical to the blueberry maggot except that is is smaller, and even this size difference is not reliable when the maggots develop in the larger-fruited blueberry hybrids. It is more than likely that these maggots were the same species originally but have become adapted to different hosts.

The blueberry maggot is admirably acclimated to survival on its host. The insect spends the winter as a maggot in a puparia near the soil surface under the blueberry bush which held the berry the maggot fed upon. At about the time berries begin to turn red in late June or early July, the flies begin to emerge from these puparia, feed for about 10 days to 2 weeks and then start to lay eggs in the ripe and ripening fruit. Individual flies may live a month or more in the field and lay 200-300 eggs so that there is an excellent chance for survival of an infestation once established in a planting. Eggs hatch in 2 to 7 days depending on temperature and whether the berry is in the sun or shade. The maggot stage lasts about 3 weeks plus or minus a few days, so that 3 to 4 weeks elapse between laying of the egg and the finish of feeding by the resulting maggot. When the maggot has finished feeding, it leaves the berry and drops to the ground and constructs its puparia in which it spends the winter. This is tan in color and is about the size and shape of a kernel of wheat.

The insect is even adapted to crop failures due to frost or whatever else might happen to kill a prospective crop. Up to 25% of the hibernating larvae do not transform to flies until the second to fourth summer after entering the soil, assuring a continuing infestation without a yearly crop. These are known as carry-over flies.

Blueberry maggots are typical fly maggots: white and legless like those of the house fly. Their injury is not spectacular until well advanced. The newly hatched maggots feed largely in the cen-

ter of the berry and softening of the fruit is minor. However, as the maggot grows it feeds throughout the entire berry under the skin, turning the contents into juice and seeds. A little pressure on the berry at this stage and the maggot will pop right out of the skin along with a gob of purple juice.

What can you do about it? One of the old admonitions was to pick on a regular schedule and to pick all ripe fruit when you picked. But now with netting to protect from bird damage, you can let them stay on for real ripening and sizing. Pickers may not be too careful to pick clean even under supervision and "pick your-own" pickers certainly will not pick the bushes clean. Clean regular picking then is next to impossible, and even if it were, remember that those hold-over flies will be here next year and the year after even though you may have been especially careful this year.

Timely applications of sprays or dusts have given proven control. To be timely, you must start before maggots are in the berries and more than one application will be necessary to protect for the picking season. Malathion and carbaryl (Sevin*) are the favored insecticides to use as they are non-hazardous and can be applied on the same day berries are picked. Up to 3/4 pounds of actual malathion as a spray or 1 pound actual malathion as a dust or 2 pounds actual carbaryl as spray or dust per acre are recommended as controls. Malathion is probably somewhat better for maggot control than carbaryl. However, where Japanese beetles are also a problem, carbaryl is better than malathion for control of it and it will give acceptable control of maggot. Start when the berries turn red and repeat every 7-10 days during the picking season.

*Trade name

****

SCORCHING OF PEAR TREE FOLIAGE

William J. Lord and Edward Vlach[1]

Last year scorch of pear tree foliage was prevalent in many Massachusetts orchards during the late summer. Frequently, the disorder was present on spur and terminals of several or more branches throughout the trees, the leaves being partially or completely brown or black. The cause of the problem was not determined and individuals differed in their diagnosis of the disorder. Generally, it was called heat scorch, mite damage, or magnesium deficiency.

We obtained leaf samples from some of these orchards for magnesium analysis. Magnesium levels varied from 0.25-0.40%, which is the same range of concentration found in "normal" apple leaves

in mid-summer. Since it has been shown that pear and apple trees require similar levels of magnesium, it was concluded that magnesium deficiency was not responsible for the damage to the pear leaves in the orchards sampled.

Since the cause of the pear leaf scorch has not been resolved, we would appreciate hearing from growers if the disorder is again prevalent in 1971.

[1]Senior Chemist, West Experiment Station, Univ. of Massachusetts

****

A NEW BOOK ON APPLES NOW AVAILABLE

George M. Kessler, Editor
Fruit Varieties & Horticultural Digest
Department of Horticulture
Michigan State University

A new book entitled "North American Apples: Varieties, Rootstocks, Outlook" which should be of interest to apple growers is now available from the Michigan State University Press, Box 550, East Lansing, Michigan 48823.

In this book, a number of outstanding pomologists and a freelance writer have succeeded, through their joint efforts, in bringing together many interesting and pertinent facts about the leading apple varieties of North America, their bud sports, certain of the minor and discarded varieties, and the important rootstocks.

In a chapter entitled "Varieties of Yesteryear", A.P. French gives a brief history and description of a number of old American varieties which have fallen by the wayside or are no longer important.

Emery Wilcox provides significant facts and figures, skillfully tracing apple variety trends in the United States and Canada during the past 27 years.

The major portion of the book consists of a series of chapters dealing with the seven leading North American apple varieties: Delicious, McIntosh, Golden Delicious, Rome Beauty, Jonathan, Winesap, and York Imperial; and the minor variety, Northern Spy. Each chapter reflects the careful research of each author, namely, Virginia Maas (the freelance writer), R.P. Larsen, W.H. Upshall, J.B. Mowry, and E.S. Degman. Fascinating episodes connected with the origin of each variety are revealed. Valuable lists of strains

and new varieties bred from the original varieties are presented by most of the authors. It is unfortunate that such tables are not prepared for Delicious and Golden Delicious, as well.

The chapter on rootstocks by R.F. Carlson is a very important part of the book, since the performance of a scion variety is strongly affected by the rootstock to which it is grafted. What is more, one can hardly deny that clonal rootstocks are themselves varieties in every way. The mechanisms by which rootstocks control size, and cause flowering and fruiting effects in the scion variety are discussed. The important clonal rootstocks are described, and their strengths and weaknesses pointed out.

"North American Apples" is concluded very appropriately and effectively with a chapter entitled "Apple Orchards of Tomorrow", by H.A. Rollins. He sees the commercial apple orchard of the future as more deliberately planned for a specific harvesting technique; as largely either on size-controlling rootstocks, or spur-types on seedling rootstocks; more intensely trained trees; and more generally irrigated and protected from frost than they are now.

****

APPLE STORAGE HOLDINGS IN MASSACHUSETTS SINCE 1933

William J. Lord
Department of Plant and Soil Sciences

The data in Table 1 for apple storage holdings on November of the years 1933 to 1970 are of interest since they reveal production fluctuations and storage trends in Massachusetts.

The first million bushel cold storage year on record was 1933. From 1933 to 1939, 2 light crops were stored, but according to records of the late J.K. Shaw of the Pomology Department of the University of Massachusetts, crop reduction was not due to frost. Winter injury and cool weather during bloom reduced crop size in 1934, and in 1938 the blossoming period was prolonged and fruit set on McIntosh was poor in spite of several days of bee activity.

During the next decade, storage holdings varied from a low of 250,000 in 1945, to a high of 2,048,000 in 1949. In 1945, the bloom period was the earliest and most prolonged of any in the past 70 or more years and fully 3 weeks ahead of normal. Records show that flower buds on McIntosh trees in Amherst were in the Pink stage on April 12. Then came cool weather on April 15, and according to J.K. Shaw, trees that had not blossomed were delayed by cool days and did not bloom much earlier than normal. As a result of these unusual conditions, storage holdings of McIntosh in 1945 were only 97,000 boxes in comparison to a million boxes the previous year.

Table 1. Apple-storage holdings (thousands of bushels) in Massachusetts on November 1, of the years 1933 to 1970.

	McIntosh			All Varieties		
Year	Regular storage	CA storage	Pct.stored crop in CA	Regular storage	CA storage	Pct.stored crop in CA
1933	588	---	---	1,090	---	---
1934	391	---	---	705	---	---
1935	663	---	---	1,054	---	---
1936	556	---	---	878	---	---
1937	657	---	---	1,111	---	---
1938	440	---	---	747	---	---
1939	979	---	---	1,309	---	---
1940	681	---	---	1,137	---	---
1941	729	---	---	1,044	---	---
1942	1,009	---	---	1,437	---	---
1943	879	---	---	1,268	---	---
1944	1,031	---	---	1,556	---	---
1945	97	---	---	250	---	---
1946	559	---	---	943	---	---
1947	874	---	---	1,558	---	---
1948	691	---	---	1,139	---	---
1949	1,463	---	---	2,048	---	---
1950	1,494	---	---	2,222	---	---
1951	1,429	---	---	2,037	---	---
1952	402	---	---	767	---	---
1953	1,258	---	---	1,754	---	---
1954	584	---	---	1,214	---	---
1955	1,430	---	---	2,166	---	---
1956	730	118	13.9	1,232	118	8.7
1957	1,362	181	11.7	1,951	194	9.0
1958	1,012	397	28.2	1,594	442	21.7
1959	1,023	437	29.9	1,630	471	22.4
1960	646	473	42.3	1,162	486	29.5
1961	1,208	585	32.6	1,791	634	26.1
1962	929	610	39.6	1,483	698	32.0
1963	661	655	49.8	1,108	746	40.2
1964	602	667	52.6	1,019	788	43.6
1965	670	699	51.1	1,128	793	41.3
1966	412	552	57.3	771	679	46.8
1967	638	623	49.4	974	747	43.4
1968	515	617	54.5	843	772	47.8
1969	454	570	55.7	804	758	48.5
1970	555	510	47.9	944	687	42.1

During the 1950's, we saw the advent of CA storage and reports of apple holdings in this type of storage. There were 3 short crops - 1952, 1954 and 1956, and 5 years with storage holdings in excess of 2 million bushels. The excessively short crop in 1952 was primarily due to a lack of bloom and/or to unfavorable weather at blossom time. Failure of many McIntosh blocks to bloom in 1952 was apparently related to an excessive crop in 1951, coupled with below average sunlight in June and July of that year which was unfavorable for flower bud initiation. Poor weather for pollination reduced crop size in 1954, and frost on May 25 reduced the crop in 1956.

Massachusetts had its largest stored McIntosh and stored crop of all varieties on record in 1961. During 1965, 1968 and 1969, more than 50% of the McIntosh crop was stored in CA. But, during the 1960's, there were only 2 years that the stored apple crop exceeded 2 million bushels.

Storage holdings of apples grown in Massachusetts may never again exceed 2 million bushels. If current trends continue, we will probably experience a gradual decline in apple storage holdings because orchard abandonment is not being offset by new plantings.

****

LATE SUMMER FERTILIZATION OF STRAWBERRIES

William J. Lord
Department of Plant and Soil Sciences

In Massachusetts, the June-bearing varieties of strawberries initiate their flower buds in the fall. If conditions are favorable, many varieties produce several flower buds in each strawberry crown and consequently produce several inflorescences per plant. The extent of flower bud development seems to be influenced by the supply of available nutrients, particularly nitrogen.

A number of experiments have indicated an advantage of building up the nitrogen supply in the fall from the standpoint of increase in flower bud formation. However, such factors as earliness of runner plant rooting, quality of plants, soil moisture, pest and weed control may have more effect on plant productivity than the fertilizer applications.

Many strawberry plantings would probably benefit from a moderate application of a nitrogen-carrying fertilizer applied between the middle of August and the first of September. Approximately 30 pounds of actual nitrogen per acre should be adequate.

This amount would be supplied by 100 pounds of ammonium nitrate or 200 pounds of sodium nitrate.

A broadcast application of fertilizer at this time may damage the foliage unless precautions are taken. Apply on a clear day of low humidity and with a switch made from brush, shake off any fertilizer adhering to the leaves or apply during a rain to avoid burning of the foliage.

****

BEFORE HARVEST IS A GOOD TIME TO EVALUATE ONE'S CULTURAL PRACTICES

William J. Lord
Department of Plant and Soil Sciences

Careful observations of the apple trees and fruits before harvest can tell the grower a great deal about his fertilizer and pruning practices. In addition, the grower can determine what alterations, if any, should be made in these practices for the coming year.

The amount of terminal growth, and the fruit and foliage color are visual guides by which the grower can make future adjustments in his fertilizer program. Only vigorous trees can produce good crops regularly. An apple tree of bearing age should make 8 to 18 inches of terminal growth per year, depending upon variety. Eight to 15 inches is desired with the McIntosh, while 12 to 18 inches of terminal growth is preferred on Delicious trees. An annual terminal growth of 20 to 30 inches should be made by young non-bearing apple trees. When twig growth is meager on bearing trees (less than 6 inches), try to determine the cause. Droughty soil, insufficient rainfall or pruning, low fertility, root injury, girdling or other factors may be the cause of poor vigor.

Visible evidence of magnesium deficiency can be seen if the deficiency exists. Necrotic brown blotches between the veins of older leaves on shoots or spurs and gradual loss of these leaves in late summer are common symptoms of magnesium deficiency.

Fruit color is an important consideration. The color of McIntosh apples has been found to be associated with both the nitrogen and potassium levels in the foliage. The fruits from high nitrogen, low potassium trees are apt to be poor in color, softer than those from medium nitrogen high potassium trees and have shorter storage life.

Our nutritional work with McIntosh trees has shown that fruits of high color are produced by trees with medium levels of nitrogen and high levels of potassium.

Before fruit color is blamed on nutrition, the grower should first determine if insufficient pruning and tree crowding are affecting color. The size, color and quality of fruit are affected considerably by pruning. The number and location of small, poorly colored apples show which branches or parts of branches need attention during the pruning season.

The time and effort spent trying to pick those apples on the high branches of tall trees should be a forceful reminder that something should be done.

****

POMOLOGICAL PARAGRAPHS

Don't Waste Money: Laboratory tests show that about six ounces of pesticide remain in a five gallon can after a good effort has been made to empty the can. Up to one quart may remain in a fifty gallon drum. Rinse the containers two or three times, emptying the rinse water into the sprayer. If a chemical costs twenty dollars per gallon, six ounces cost almost one dollar. - (From Delaware "Pesticide Briefs" #3)

The Apple Maggot: According to Dr. Merrill L. Cleveland, Assistant Chief of USDA's Fruit Insects Branch at Beltsville, Maryland, apple maggots have the potential to cause a 100 percent loss of the apple crop; however, the utilization of insecticides holds the loss to less than 1 per cent.

According to the USDA, apple maggots are a problem mostly in the New England states, New York, and the Great Lakes states. They also infest apples to a lesser extent as far south as Georgia and westward to the Dakotas, Nebraska, Kansas and Oklahoma.

Ideally, for satisfactory maggot control, all the hosts (neglected or wild apple trees and native hawthorne bushes) should be removed from the area. Apple maggot management problems decrease with the enlargement of such sterile areas. Orchardists should not only attempt to eradicate all alternate hosts and abandoned apple trees but, at the same time, use proper control methods to combat the maggots in their own orchards. - G.L. Jensen, Extension Entomology.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE. THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING! PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914
Official Business

Postage and Fees Paid
United States Department of Agriculture

MR. RADIE H. BUNN FN
COLLEGE OF AGRICULTURE, RM. 211
STOCKBRIDGE HALL

01002

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

SEPTEMBER–OCTOBER, 1971

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

SOME INNOVATIONS IN THE OPERATION OF CA ROOMS

R.M. Smock
Cornell University

Dr. P. Marcellin, a French research worker, has developed two very ingenious units for maintaining the atmospheres in CA storages. We have tested both of these units to see if they had any application for American conditions.

The first idea involved covering an entire pallet load of apples with heavy polyethylene film with a silicone rubber "window" in it. Field heat is first removed from the pallet and then the apple crates are sealed in this heavy weight polyethylene with the "diffusion window." The theory is that carbon dioxide and oxygen will diffuse through this membrane or window much like animal lungs exchange oxygen and carbon dioxide. Our tests with this unit showed that one really should analyze the pallet load of apples at least every few days. Such frequent analyses of so many pallets is not practical. If the oxygen goes too low, one is supposed to take out some of the apples from the pallet load. Extra space must be left around the pallets for movement to remove or add apples. The system just didn't seem to be practical for our situation in the USA. In France, it is used in caves where space is not such a problem.

The second idea of Dr. Marcellin involved a unit that is attached to a commercial CA room. Large "bags" are suspended in a cabinet with positive air movement to and from the CA room. If the oxygen drops too low in a CA room, one opens up one or more bags that were previously not in operation. If the carbon dioxide goes too high, the same move is made. We did a number of tests with this unit and our conclusions follow. The systems are not "automatic." One needs to analyze daily and open or close the bags as required. We were not convinced that the unit could maintain a 2% carbon dioxide level as is required for Delicious, Golden Delicious and certain other varieties. Circumstantial evidence pointed to the fact that the unit worked best at 37-38^{o}F. This also would mean that we could not use it for "hard rooms" at 32^{o}F. In our trials we could not get as exact control of the atmospheres as we could with water or dry lime scrubbing. The unit would not be as cheap as water or dry lime scrubbing.

An innovation that comes from Holland is the "Oxy-drain" unit. This unit is a nitrogen generator that employs ammonia as the gas instead of propane. The ammonia is "cracked" in the machine and the hydrogen produced is burned. As a result one gets nitrogen produced with very low oxygen levels. This is similar to Tectrol (no longer produced) or Arcat units except that no carbon dioxide results from combustion. As a result no scrubber is needed to

care for the carbon dioxide produced by the unit. G.D. Blanpied, at Cornell, has burnt hydrogen in an Arcat unit as a means of burning out the ethylene in CA rooms. It is not clear that there was any advantage in this, however. The trials on this machine have been made in Holland and we do not have comparative costs for it and Arcat. The costs of removing the carbon dioxide produced by the Arcat unit during the pull down period are not very high if one uses dry lime.

****

CIDER NOTES

K.M. Hayes
Department of Food Science and Technology

Quality

Consumers are becoming more critical of everything they buy--not only from a price aspect, but from a quality point of view. With living costs continually rising, consumers want value for their money. Quality in food refers to taste, appearance, color, cost per serving, and keeping quality.

Cider is not a necessary food item in most budgets. Cider is basically a beverage to be enjoyed, and if the quality is low or the keeping quality poor, repeat purchases can easily be eliminated.

Have you examined your cider critically as a consumer would? Take a half gallon and subject it to the conditions that the buyer does. Taste a glassful--is it musty? chlorine off-flavor? taste like dirty press cloths? insipid? Do this until the container is empty. Did it start to ferment? Did the last glass look and taste like the first? Or, go out and buy from several other stands, have your wife pour samples including yours in unmarked glasses--now taste and judge. If you pick your own as best, now try to maintain the year's run that way or even improve. If yours comes out second or third best, what is wrong? Remember, quality is a silent salesman!

Sanitation

The keeping quality of cider is directly related to the sanitation practices observed during the operating season. Unsanitary practices foster the growth of microorganisms, which cause fermentation or produce undesirable flavors in the final product.

After a day's run, observe the following procedures in cleaning the cider plant:

Dismantle the press for cleaning. Rinse it thoroughly with a hose to remove surface dirt. Scrub all parts of the press thoroughly, using a sanitizing or detergent-sanitizing solution. Where possible, use hot water, for both the rinsing and the scrubbing operations.

Sanitizing compounds may be of the chlorine or quaternary ammonium types. Dairy-cleaning compounds are usually of these types, and they are easily obtained. Directions given by the manufacturer of the solution for cleaning dairy equipment will be satisfactory for cider plants.

Refrigeration

Many cider mill operations including all certified operators use refrigeration to preserve cider. Cider should be cooled immediately after pressing and stored at a temperature between 32° and 36°F. At these temperatures, cider retains its original flavor for one to two weeks without danger of fermentation. Settling can take place under refrigeration.

Refrigeration is especially adaptable where cold storage facilities for fresh fruit are available. If a refrigerated room is not available, the operator can install an insulated tank and cool the cider with a small refrigeration unit.

For display purposes at roadside, used upright display cabinets with glass doors are excellent. These self-contained units can be often purchased from companies supplying equipment to retail stores. Household refrigerators can also be used. The important feature when making and selling cider is to keep it under refrigeration at all times to maintain the quality.

****

POMOLOGICAL PARAGRAPH

Jonathan spot on Idared apples: Last season, a storage disorder that has been identified as Jonathan spot developed on Idared apples in Massachusetts. This comes as no great surprise, since Jonathan is one of the parents of Idared.

Jonathan spot appears as a discoloration of the skin, ranging from bluish-black to brown on the blushed portion of the fruit, and from greenish-brown to brown on the unblushed portion. Spot

sizes range from barely visible to half the size of a dime, often on the same fruit. Initially, the spots appear as small, round areas, then increase in diameter and eventually join to form large, irregular, discolored patches. Upon aging, the spots become brown.

The cause of Jonathan spot is unknown, but it is accentuated by late harvest. Reasonable control can be obtained by limiting the storage period in air at 32°F to no more than 60 days, or by storing the apples in 32°F CA storage at 3% O_2 and 2% CO_2.

****

SOIL TREATMENTS FOR NEMATODE CONTROL ON STRAWBERRIES

Richard A. Rohde
Department of Plant Pathology

There are probably very few commercial strawberry growers in the state, who are without some experience with soil fumigation. This experience may range from personal use, to observation of a neighbor's fields, to demonstrations by regional specialists or chemical companies. Reactions vary from enthusiastic acceptance to lukewarm skepticism and many feel that it is probably a good idea and "maybe I'll try it next year." If next year is to be that year, now is the time to plan fall soil fumigation in preparation for new beds to be set next spring.

Why fumigate? Fumigation is practiced to control disease organisms in the soil. The main culprit here is the lesion, or meadow nematode, a microscopic worm which burrows through roots, feeding and laying eggs, and, together with several species of fungi, brings about a condition called "black root rot." This disease was in part responsible for the decline of the strawberry industry in the Cape Cod area several years ago and is still apparent throughout the state. Publications from New Jersey and further south mention root-knot nematodes, but we do not have this pest. The root-knot nematode that causes lumps on carrots will not attack strawberries.

The soil fungi that cause the diseases Red Stele and Verticillium Wilt are not generally controlled by fumigation, although control is possible under some conditions by using large amounts of chemical. More commonly, soil fumigation brings about a response spoken of as the "I.G.R." effect. The I.G.R. effect, or Increased Growth Response, is presumed to occur because secondary pests are killed at higher rates of fumigation and plants simply grow more vigorously in their absence.

Should I fumigate? Each field has its own set of conditions, and whether or not disease organisms build up to a point where they cause trouble is largely a matter of crop sequence, temperature, moisture, organic matter, and a host of unknowns. Many of these unknowns will also determine whether or not a chemical treatment will work. Poor growth of plants will lead you to suspect a problem, a soil test may confirm that a nematode problem is present, and a trial application of chemical may lead to better growth.

What can be used? Listed below are fumigants registered for use in Massachusetts. All are liquids that are injected into soil before planting. They become gases that diffuse through all parts of the soil mass. There are a number of factors that can influence their effectiveness: organic matter absorbs these fumes; soil water fills air spaces and prevents their spread; and at low temperatures disease organisms are very resistant to toxic fumes. More than any other group of pesticides, fumigants must be applied precisely according to directions. Unless the soil temperature, texture, moisture, and organic matter are right, and the proper amount of chemical is deposited at the right depth and is sealed in properly, the entire treatment may be useless.

Chemical: (Brands)	Remarks
ethylene dibromide (Dowfume W-85*) dichloropropene - dichloropropane mixture (Shell D-D*, Vidden-D*) dichloropropene (Telone*)	Preplant fumigants used primarily for nematode control.
dichloropropene mixture plus methyl isothiocyanate (Vorlex*)	Lowest rates recommended by manufacturer give primarily nematode control. Increased dosages give additional soil fungus and weed control.

Companies which manufacture soil chemicals can supply detailed information on application equipment. In addition, custom applicators are available who will not only apply treatments, but can give advice based on their rather wide experience.

The chemicals listed above are those generally in use. In addition, your regional specialist can supply you with the names of others that may be of use under special conditions. One of these is DBCP (Nemagon*, Fumazone*), a fumigant which does not injure strawberries at low rates and can be used on growing plants.

* Trade name

A final word should be added about the importance of clean plants. It does no good to fumigate soil if disease organisms are immediately added back to the soil with the roots of new plants. The use of healthy-appearing planting stock from a reliable souce is the best insurance against this.

****

HARVESTING AND STORING PEARS

W.J. Bramlage and J.F. Anderson
Department of Plant and Soil Sciences

Most pears grown in New England are marketed locally by the grower, which means that high quality is necessary for repeat sales at the roadside stand or retail store. Pears can be a very high quality commodity, but producing this quality requires special care. The fruit must be harvested at the right stage, stored correctly, and ripened properly to produce this premium quality.

Unlike most fruits, pears cannot be tree-ripened, because they will develop internal breakdown. They must be harvested green, but at a rather definite stage of maturity. This maturity is best determined by flesh firmness, and it has been repeatedly found that the Magness-Taylor pressure tester is an adequate tool for this determination. This is in marked contrast with apples, where the pressure tester has very limited value as a maturity index.

In determining pear maturity, the Magness-Taylor pressure tester is used the same way as on apples, with one very important exception: a 5/16" diameter head must be used instead of the 7/16" head used for apples. Since the green pears are much harder than apples, the smaller head is essential to get a meaningful reading. Using the 5/16" head, the following pressure-test ranges have been established as indices of optimum maturity for major varieties: Bartlett, 20-17 pounds; Bosc, 15-12 pounds; Anjou, 15-13 pounds; Comice, 13-11 pounds; Gorham and Flemish, 14-12 pounds.

It is important that pears be harvested at the proper stage of maturity. Fruit picked too early tends to shrivel in storage and to develop poor quality when ripened, while over-maturity results in shortened storage life and the development of breakdown disorders. Susceptibility to certain physiological disorders, especially CO_2 injury, is associated with advanced maturity.

All varieties of pears can be stored safely at the lowest temperature at which they will not freeze, which ranges from 27° to 29°F.

Therefore, in a storage with a good temperature-control system, pears should be stored at 30°F for maximum storage life. Storage at 30° rather than 32-34° will lengthen storage life significantly.

Since pears are quite prone to shriveling, especially at the narrow stem-end of the fruit, humidity control is particularly important. Maintaining the storage at 90-95% R.H. is considered to be optimum. However, packing the pears in perforated polyethylene bags is an excellent way to control shriveling due to moisture loss.

The Anjou variety of pear is very susceptible to scald. It has been found that dipping the fruit in 2700 ppm ethoxyquin (Stopscald*) will provide adequate control of this disorder. A fungicide is commonly applied with the Stopscald to reduce decay during storage. Two new fungicides currently being tested show great promise for controlling decay of pears. Benomyl at 300-500 ppm and thiabendazole at 500-700 ppm, both applied as a postharvest dip, have given excellent decay control on pears. However, neither material has yet received EPA clearance and therefore, neither may yet be used commercially.

Pears have been shown to respond well to CA, although the commercial adoption of this storage method has been less for pears than for apples. It has been found in the West that the best atmosphere for Bartlett and Anjou is dependent on the maturity of the fruit. If picked at the recommended firmness, 1% O_2 and 5% CO_2 produce a major benefit in preserving quality. However, if the fruit are softer than this at harvest, they possess a sensitivity to CO_2 that results in the development of browncore. In California, it is recommended that such fruit, if stored in CA, be held at 1% O_2 and near 0% CO_2. In New York, tests have produced a recommendation of 2.5% O_2 and less than 2.5% CO_2 for maximum benefits on Bartlett and Bosc, and these recommendations may be considered as best for Eastern-grown pears. This recommendation does not make a distinction for maturity differences, because pears destined for storage should be harvested at the recommended firmness.

The New York tests have shown that while pears and apples can generally be stored together without harm, an interaction between Bartlett pears and Delicious apples can occur that results in an increased rate of breakdown of the pears. It would therefore appear wise to store apples and pears separately if possible.

Varieties differ in their storage life, and this inherent difference is accentuated by the harvest maturity and the storage conditions to which they are subjected. In general, however, Bartletts seldom keep well beyond December-January, Boscs beyond February, or Anjous beyond March. Pears may lose their capacity to ripen properly with too-long storage, and this terminal point of storage is usually shown by light yellowing of the skin of pears in the storage room.

---

* Trade Name.

Perhaps the greatest deterrent to prime quality is improper ripening of pears. Most pears do not ripen in storage, thus must be ripened after storage. All that is needed to achieve peak quality is to hold them at 60-65^{o}F until sufficiently soft and yellow, yet only too often they never attain this peak. Proper ripening is the culmination of all the grower's efforts to provide the consumer with a high quality item. If the pears are not ripened or are ripened at too high or too low a temperature, not only is the consumer being robbed of quality, the grower is being robbed of the satisfaction, reputation, and repeat sales that could have been generated by that lost quality.

****

PAINT OR WHITEWASH FOR PEACH TREE TRUNKS

William J. Lord
Department of Plant and Soil Sciences

At a twilight meeting last May, the author mentioned seeing peach trees in New Jersey painted with either latex paint or whitewash to help reflect heat and keep trunks cooler during warm days in mid-winter. On sunny, winter days, large amounts of heat are accumulated by the tree trunk and trunk temperature may rise 40^{o}F or more above air temperature. At night, trunk temperatures fall to near air temperature. If the tissues are not dormant, the extreme temperature fluctuations can cause injury to the cambium (dividing) and phloem (food conducting) tissues in the trunk and upward into the lower scaffold limbs. Winter-injured trees are more susceptible to peach cankers which cause extensive damage in Massachusetts.

It was suggested at the twilight meeting that some information concerning the recommendations in New Jersey for painting or whitewashing peach tree trunks be included in Fruit Notes. The information below was obtained from an article in January, 1971, issue of Horticultural News published by the New Jersey State Horticultural Society and prepared by E. G. Christ, Extension Pomologist, Rutgers University.

"Peach trees that are 3 to 5 years of age are most susceptible to cold damage and it has been shown that the southwest side of the tree trunk can reach temperatures as much as 45^{o} or 50^{o} F. higher than the air temperature on a sunny day in January and February. A study in Hammonton during the winter of 1965-66, reported in November, 1966 Horticultural News, showed on one day, February 8, 1966, air temperature was 39^{o}F. The whitewashed southwest side of a peach tree reached a maximum of 52^{o}F., but the unpainted tree trunk was at 84.5^{o}F. The air temperature dropped to 14.5^{o}F. at 1:00 a.m. on February 9. This was the greatest drop in temperature

(70 degrees) in the bark of the tree trunk in a 12-hour period.

Some growers have used latex paint and some use whitewash. Whitewash is cheaper, of course, but does not last as long. Les Miller, Agricultural Agent in Camden County, has tried many whitewash mixtures and the best for applying with a spray gun is as follows:

For 100 gallons of water, add 300 to 400 pounds of hydrated lime plus 2 to 3 pounds of table salt plus commercial spreader-sticker. This mixture sticks best if drying is slow and after a rain when the trunk is wet or damp."

(Editor's Note: For more detailed information on "Cold Injury to Peach Trees", refer to an article by William J. Bramlage in the January-February, 1971, issue of Fruit Notes.)

RABBIT CONTROL IN BLUEBERRIES

By:
Edward R. Ladd, Wildlife Biologist
U. S. Fish and Wildlife Service
451 Russell Street
Hadley, Ma. 01035

Cottontail rabbits are important game animals, and they furnish a great deal of hunting recreation. However, in small, local areas rabbits may cause a great deal of damage to blueberry crops, orchards, and nursery stock. It is in situations such as these that control measures are necessary to prevent damage.

Rabbits, like most animals, have living area preferences. Any area supporting dense vegetative cover, such as overgrown ditches, brushy fence rows, or brush piles, may harbor these animals. One method of controlling rabbits is to modify or remove the cover they need for protection. A good mowing, brush cutting, or general clean-up and removal of vegetation and brush may be all that is needed to control them.

Use of taste repellents is another method of reducing rabbit damage. When properly applied, repellents make treated plants less desirable as food. Three factors determine the effectiveness of a repellent: thoroughness of application; weather conditions; and proximity of existing rabbit food and cover. All areas of the plant which may possibly experience damage should be covered completely. Application must be heavy enough to withstand adverse weather conditions, since frequent rains and snows erode and dilute the material from treated plants and reduce the amount of protection it offers. Repellents containing thiram or Z.A.C.* have proven to be most effective. For best results, the manufacturer's recommendations should be followed.

*Trade designation

For winter protection, all bark, stems and twigs to a height that rabbits might reach during the heaviest snow accumulation must receive a complete and heavy application. Treatment should be made in the fall, prior to snowfall.

After a series of heavy storms, or by midwinter, the blueberry bushes should be checked to determine if the repellent is still giving adequate protection. If damage is occurring, retreatment should be made on the first warm day.

Fencing is a third method that can be used to protect relatively small areas of blueberries. Any fence of 2-inch mesh that is tightly staked to the ground and is high enough to be well above the maximum snow depth, will give protection.

Live trapping also can be an effective means of removing individual animals causing damage to blueberry bushes. Although rabbits are active at any time of day or night, the peak of their activity occurs just before sunrise and just after sunset; thus, live traps should be set prior to these peak activity periods. Rabbits usually do not have definite trails going from their cover to their feeding grounds. There may be one or two fixed points where rabbits regularly enter. Those areas showing constant rabbit activity, or damage, are the logical places for setting live traps. (Note: Rabbits are game animals in most states; therefore, State Game Laws or the Conservation Officer should be consulted before trapping.)

In areas having a high rabbit population and a constant history of injury, rabbit damage to crops may be reduced by hunting the animals. During the legal hunting season, local hunters should be encouraged to hunt in these areas.

****

POMOLOGICAL PARAGRAPH

The "Mini" Fashion in Skirts and Cars seems to have spread to the apple orchard in the form of mini-trees. This idea of a high density planting comes from Dr. J. P. Hudson of the Long Ashton Research Station in England. About 50,000 mini-trees on EM IX are planted per acre to produce 100 tons of apples every two years. In the first year of planting, the trees are sprayed with Alar, a growth inhibiting chemical, which encourages the production of flower buds and fruiting. The apple trees are harvested mechanically the following year by "mowing" the trees about 2 inches above the draft union. The next year new shoot growth occurs, and flower bud formation is again controlled with chemicals when growth is about 2 feet in height. The cycle is repeated biennially. This type of culture facilitates complete automation of the operation: irrigation, pest control, fertilizer addition, and climate control. It also enables apples to be grown more efficiently as a row crop than as an orchard. Research and development of this mini-tree culture are being continued by the staff at Long Ashton.-- L. D. Tukey, Penn. State Hort. Reviews: 20 (no. 1), January, 1971.

ORCHARD MOUSE IDENTIFICATION

Edward R. Ladd, Wildlife Biologist
U.S. Fish and Wildlife Service

PINE VOLE

Small Body

Short Tail

Sunken Eyes

Fine, Brown Fur

Burrows Underground

MEADOW VOLE

Large Body

Long Tail

Prominent Eyes

Coarse, Brown Fur

Makes Surface Trails

ADULT MALES (3/4 actual size)

These are the two mice that cause considerable damage to apple orchards during the winter months.

Measurements and weights of the mice in the photograph are:

Specie	Weight	Total Length	Tail	Hind Foot
Pine Vole	21.5 grams	4-3/8 inches	5/8 inches	5/8 inches
Meadow Vole	34.3 grams	6-3/8 inches	1-5/8 inches	7/8 inches

Presence of either of these animals should be suspected if trees

are losing their vigor, leaves are small and have a yellowish cast, or if suckers or water sprouts have emerged--indicating root damage.

Both Pine and Meadow Mice may or may not inhabit the same area at the same time. Consequently, it is wise to examine the orchard for both species and utilize the recommended control measures.

PINE VOLE. Although not as abundant as the Meadow Vole, this animal is found in many orchards in the State. It may be present throughout the orchard, or its presence may be restricted to an area of only a few trees. Pine Mice are burrowing rodents, with an underground system of trails that emerge periodically to the surface. In the late fall, these emergent corridors frequently can be identified by the pile of fresh soil pushed out by these animals. The holes and underground trails are smaller in diameter (seldom exceed 1-1/4 to 1-1/2 inches) than those made by Meadow Mice. Damage to trees by the Pine Vole is below the ground surface and consists of chewing and girdling the root system. Because the damage is unseen, it must be discovered before severe tree damage occurs.

MEADOW VOLE. This animal has a wide distribution and frequently large populations. It is found in almost any area of dense grass cover, where it builds a maze of surface trails. Its presence is easily detected by parting the grass and looking for the trail system and its associated piles of fresh grass clippings and droppings. Damage caused by the Meadow Vole usually is above the surface of the ground, and on apple trees consists of bark chewing or complete girdling of the stem. Quite often tooth marks up to 1/8-inch will be found on the damaged stem.

****

ORCHARD MOUSE CONTROL

Edward R. Ladd, Wildlife Biologist
U.S. Fish and Wildlife Service

Do you know that the most numerous mammals on earth are the voles Untold millions of these mouse-like animals inhabit the Northern Hemisphere. Parts of this large group of animals are the pine and meadow mice, found in the orchards of Massachusetts. These two animals, like all voles, are extremely prolific. They have 4-8 young at one time and up to several litters per year. In a "number game" such as this, it is easy to see why fruit growers must do something each fall to protect their orchards from the damage pine and meadow mice may cause during the winter.

As in previous years, a permit for bait application must be obtained from the Massachusetts Division of Fisheries and Game, 100 Cambridge Street, Boston, Ma. 02202, before any control work is started.

Meadow mice can be controlled adequately with a fall application of Zinc Phosphide-treated grain. On large acreages, the use of the Trail Builder Machine or broadcast method, at the rate of 6-10 pounds per acre, is most practical. Limit broadcasting to the tree row or block being treated; this is where the most protection is needed. All sections of the orchard having meadow mice should be treated once. Those sections having an overabundance of mice should receive a second treatment. Hand broadcasting or placing of apple cubes treated with Zinc Phosphide Rodenticide is a good followup method for the trouble spots.

In hand broadcasting, the following guidelines may be useful:

10 pounds of Zinc Phosphide-treated Oats = 900 teaspoon-size baits OR enough to treat approximately 225 apple trees.

1 ounce of Zinc Phosphide Rodenticide will prepare 16 quarts of 1/2-inch apple cubes, and will be enough to treat approximately 400 apple trees.

The adequate control of pine mice still depends upon placing the baits where the mice can locate them. Since these mice spend most of their time in underground burrow systems, baits that are broadcast will not give consistently good control. To date, trail baiting either with the Trail Builder Machine or by hand placement in the runways has been the only effective method of pine mouse control. The recommended materials are the Zinc Phosphide-treated baits that are used for meadow mouse control.

To achieve proper mouse control, choose weather conditions carefully. Three consecutive days of warm, sunny weather will give the best results. Under these conditions, the mice will be most active and most apt to locate and feed on the bait placements.

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914
—
Official Business

Postage and Fees Paid
United States Department of Agriculture

MR. RADIE H. BUNN FN
COLLEGE OF AGRICULTURE, RM. 211
STOCKBRIDGE HALL

01002

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

NOVEMBER–DECEMBER, 1971

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

NEW ENGLAND FRUIT MEETINGS AND TRADE SHOW

The New England Fruit Meetings and Trade Show will be held at the New Hampshire Highway Hotel, Concord, New Hampshire. The meetings are scheduled for January 5 and 6, 1972.

The hotel is accessible from all major highways. Routes 3 and 93, which lead to Concord, are accessible from anywhere in Massachusetts. Persons coming from Western Massachusetts and Southern Vermont may find the most convenient route to be Routes 9 or 10 to Keene, New Hampshire, and then Routes 9, 202, 89 and 93 to the Highway Hotel.

This year a buffet meal is planned on the evening of the first day instead of the banquet. The buffet will be followed by a short speaking program and then dancing.

For the Woman's Program at 2:00 P.M. on January 5, we are fortunate to have Mr. George Michael as host. George Michael is well-known as the Editor of the monthly magazine, the National Antiques Review, and has authored three books: ANTIQUING WITH GEORGE MICHAEL, THE TREASURY OF NEW ENGLAND ANTIQUES and the forthcoming ANTIQUES OF THE FEDERAL PERIOD. He has served as antiques columnist for the Christian Science Monitor, N.H. Profiles Magazine, and still does a weekly column on N.H. Americana for the statewide N.H. Sunday News.

Listed below are the tentative topics and speakers as of October for the N.E. Meetings.

Increasing Calcium Content in Apples
Miklos Faust, USDA, Beltsville, Md.
Incorporation of Family-Held Farm Business
John Drayton, C.P.A., Manchester, N.H.
Fruit Growing in Urban Southeastern Pennsylvania
Tom Styer, Langhorne, Pennsylvania
Integrated Pest Management in Apple Orchards in Pennsylvania
Dean Asquith, Pennsylvania State University
Air Pollution of Vegetation in the Northeast
John Naegele, University of Massachusetts
Panel Discussion on - Agricultural Land Use, Value and Assessment
Eugene Engel, University of Massachusetts, Moderator
(Names of panel participants will appear on the program)
Single Applications of Fungicides for Scab Control
M.T. Hilborn, University of Maine
New Apple Varieties
James Cummins, Cornell University
Apple Tree Performance on Size-Control Rootstocks
James Cummins, Cornell University

****

APPLE JUICE OR APPLE CIDER

K.M. Hayes
Department of Food Science and Technology

Many consumers ask, "What is the difference between apple juice and apple cider?"

Apple juice is generally understood to be sweet cider that has been treated by some method to prevent spoilage as long as the can, bottle, or other type of container is kept hermetically sealed. Sweet cider is generally thought of as the product sold fresh without any permanent preservation treatment.

I tend to describe apple juice as being less brown than cider, clear, and having been treated. Sweet cider, on the other hand, has more body (and flavor), is dark brown and is fermentable after a week or 10 days. One could go on and on by describing packaging, sales outlets, geographical distribution area, etc. Another description might be that one seldom finds apple juice being sold at roadside markets.

To sum up and give you a legal definition, this is USDA's definition of canned apple juice:

Canned apple juice is unfermented liquid prepared from the first pressing juice of properly prepared sound, fresh apples, excluding the liquid obtained from any additional residual apple material. Such apple juice is prepared without any concentration, without dilution, or without the addition of sweetening ingredients; may be processed with or without the addition of antioxidants; and is sufficiently processed by heat to assure preservation of the product in hermetically sealed containers (either metal or glass).

Doesn't <u>fresh</u> <u>sweet</u> <u>cider</u> sound better?

****

EUROPEAN APPLE SAWFLY - ITS LIFE HISTORY AND CONTROL

Gary L. Jensen
Department of Entomology

The European apple sawfly *(Hoplocampa testudinea)* is regarded as a minor pest of apples in the United States according to Dr. Merrill Cleveland, Assistant Chief of the U.S.D.A. Fruit Insects Branch at Beltsville, Maryland. However, its limited distribution may be the primary reason for this classification because where European apple sawflies are found, entomologists, County Agents and growers often regard it as a serious pest of apples.

One of our Regional Fruit Specialists reports that scars from European sawfly larvae feeding are the most prevalent insect injury on the Massachusetts apple crop.

Life Cycle and Description

Adult sawflies are about 1/4 inch long, dark brown or black dorsally (on top) and yellow-brown ventrally (underneath). Their heads and antennae are yellow, while the eyes are black.

The sawflies overwinter as full-grown larvae encased in small parchment-like cocoons in the upper 2 or 3 inches of soil under infested apple trees. In the spring, the larvae change to pupae and then to adults. Adults emerge from the soil at about the time the early apples bloom. Thus, early apple cultivars are the most seriously damaged by this insect.

Adults are active in the orchard for a period of one to two weeks. The females lay one or two oval, shiny colorless eggs at the blossom end of newly developing apples. In a week to 10 days, the eggs hatch and the tiny larvae start to tunnel just beneath the surface of the apple skins, often in a spiral starting at the calyx end. As the larvae mature, they change their feeding habits. They emerge from their tunnel and enter the side of the apple or a new apple and tunnel directly toward the core. At this stage, a characteristic deposit of reddish-brown frass is readily noticed on the surface of the young developing apples. After reaching the core, the larvae work back toward the surface of the fruit and soon leave to enter other apples. One larva may thus injure several fruits. All fruits that are tunneled to the core fall during "June drop" while those only tunneled underneath the surface of the skin remain on the tree until harvest. It is these apples, scarred by the feeding, that attract attention during grading and packing operations but are not necessarily an indication of the more serious damage that resulted earlier in the season.

The young sawfly larvae, which are sometimes confused with the larvae of the codling moth, are white with black heads which later become yellow. They are never pinkish in color as are cod-

ling moth larvae, and they have 8 pairs of prolegs on the abdomen, while codling moth larvae have only 5 pairs of prolegs. Additionally, the damage caused by sawfly larvae occurs earlier in the spring than codling moth damage. By late June the sawfly larvae are fully grown and leave the fruit to spin their cocoon in the soil where they remain until the following spring when they emerge as adults.

Control Measures

The European apple sawfly should be controlled at the petal fall stage as soon as three-fourths of the petals have fallen. It is important to get some of the spray material into the calyx cup before it closes, which means an application as soon as the petals fall. Guthion*, Gardona*, parathion and dieldrin are all effective; however, the effectiveness of Imidan* and Zolone* are not fully known.

*Trade name

****

TEMPERATURE FOR McINTOSH CA ROOMS

CA operators should not endeavor to improve the marketable life of apples by reducing the temperature of McIntosh CA rooms to 35-36^{o}F. There is no evidence that this reduction in temperature (compared to the recommended 37-38^{o}F) will improve the keeping quality of McIntosh. On the other hand, there have been some reports of occasional marked increases in flesh browning (considered to be CO_2 injury) in some CA rooms in New York State where a few CA operators have maintained temperatures at 35-36^{o}F. Apparently, we also have a few people in Massachusetts who have been holding McIntosh in their CA rooms at 35-36^{o}F. It is quite possible that fruit injury may not appear in most years or only on occasional lots of fruit in a given room. Obviously, the absence of benefits from lowering the temperature to 35-36^{o}F do not warrent the risks involved.

F.W. Southwick

****

POMOLOGICAL PARAGRAPHS

Registration of amino triazole cancelled: On June 16, 1971, the Environmental Protection Agency issued an order cancelling registration of amino triazole (amitrole) for use on food croplands. This means that the use of Amizine* which is a mixture of amitrole and simazine, for broadleaf weed and grass control in non-bearing

and bearing orchards is no longer permitted. No other chemical containing amino triazole has been recommended for orchard use in Massachusetts for the last several years.

*Trade name

****

Is cross pollination important for strawberries? Research conducted at the University of Vermont indicates that it is.

Each strawberry blossom contains from 100 to 500 pistils, which must be individually pollinated and fertilized by separate grains of pollen. The more pistils that are fertilized, the larger and better formed will be the fruit; if fertilization is incomplete, the fruit either fails to form or else forms but is misshapen.

Pollination may occur through the action of gravity, wind, or insects, especially solitary bees. Tests were recently conducted at the University of Vermont to determine which is the most effective means of pollination. Some plants were covered with plastic and blossoms were hand-pollinated; others were covered with screens and blossoms were wind-pollinated; others were covered with plastic and blossoms were not pollinated. Still other plants were left uncovered and allowed to be insect-pollinated.

Those plants left uncovered and allowed to be insect-pollinated had twice the yield of hand-pollinated plants and several times the yield of wind-pollinated plants, and plants on which blossoms were not pollinated produced no fruit. Berry size was largest where insect pollination had occurred, and presumably cross-pollination had occurred.

One of the practical implications from this research is the importance of applying insecticides for control of cutworms and other pests prior to blossoming, so that insect pollinators are not killed by these chemicals. - Dominic A. Marini, Southeast Region.

****

THE HARROW PEACH VARIETIES

J.F. Anderson
Department of Plant and Soil Sciences

There has been much interest expressed in the new Harrow peach varieties by growers in Massachusetts. Since these varieties have not been tested in our college plantings, we have secured per-

mission to reprint descriptions and comments on the Harrow varieties as found in the University of Kentucky Miscellaneous Publication 371-B, Peach Variety Performance - 1970. This publication, describing the performance of some 36 varieties is the result of a cooperative variety evaluation program maintained by Frank T. Street, Peach Grower, Henderson, Kentucky, W.D. Armstrong, Extension Horticulturist, University of Kentucky and L.M. Caldwell of the West Kentucky Experiment Substation.

Unless otherwise noted, the descriptions of the following Harrow varieties is based on their performance in Mr. Street's orchards at Henderson. The dates under the variety name is the average of the harvest dates for 1968, 1969, and 1970, the first date indicating the beginning and the second the end of harvest for that variety.

Harbelle (Harrow 429) (H) *July 5-10* *5 weeks before Elberta*	Nonbrowning, a winter-hardy attractive, productive freestone. Medium-sized, firm fruit with snappy red color, rich flesh color, of average quality. Prominent tip. Holds well. May be replacement for Sunhaven. Overlaps Garnet.
Harken (Formerly Harrow 2066) *July 16-28* *3-4 weeks before Elberta*	Named in 1970 after 3 years of heavy production at Henderson, Ky., as Harrow 2066. An outstanding prospect! Very nonbrowning, medium-large, very long hanging, high quality, attractive red, with bright yellow ground color developing very early. Firm fleshed. Highly resistant to *B. pruni*.* Reportedly more bud hardy than Redhaven. Yellow freestone.
Harbrite (Harrow 430) *(Same season as Harken)* *3-4 weeks before Elberta*	Obtained but not yet fruited in Kentucky. Description taken from Canada. Winter hardy, resistant to *B. pruni*. Fruits bright with 70% red color. Sizes readily. Flesh is rich yellow. Nonbrowning. A sister variety to Harken, ripening at the same time. Yellow freestone.
Harmony (Canadian Harmony) (Harrow 1748) *July 29-August 6* *1-2 weeks before Elberta*	Nonbrowning; a large firm peach with 80% bright red over attractive background. Stays firm. Reported very winter hardy. Productive, high quality. May become a substitute for Loring where a hardy peach is required. Had some *B. pruni* on leaves in 1970, but none on fruit. Yellow freestone.

*Bacterial leaf spot

****

PUBLICATIONS AVAILABLE

Available from Washington State University, Pullman, Washington is E.M. 3462 entitled *'Bitter Pit' - A Physiological Disorder of Apple Fruit.* This publication describes the symptoms of bitter-pit and discusses its occurrence, probable cause and cultural practices influencing its development in fruit.

Available from the Cooperative Extension Service, University of New Hampshire, Durham, N.H., are the publications on small fruit culture prepared by Dr. C.A. Langer, Extension Horticulturist, Plant Science Department.

Strawberry Culture for New Hampshire - Information Guide #21
Cultural Techniques for Growing Grapes in New Hampshire - Information Guide #20
Raspberry Culture for New Hampshire - Information Guide #22

****

POMOLOGICAL PARAGRAPHS

William J. Lord
Department of Plant and Soil Sciences

Golden Delicious. Grower interest in Golden Delicious has waned considerably in Massachusetts by those who wholesale this variety. The problem of russet and poor financial returns appear to be the main reasons for the decreased interest in this variety.

Plantings on EM VII Rootstock. In some orchards, tree performance on Em VII rootstock is less than satisfactory for one or more of the following reasons: poor soil, poor anchorage, inadequate nutrition, failure to prune and general lack of care. Our suggestions for growing young apple trees appeared in the May-June, 1968, issue of *Fruit Notes*. Growers should be more selective when choosing sites for plantings on size-controlling rootstocks and be more concerned about soil preparation prior to planting and tree care after planting, Being weaker growing, the trees on EM VII rootstock reflect growing conditions and care more sharply than those on seedling rootstocks.

Plantings on EM IX Rootstock. Following talks about the European fruit industry and their highly productive plantings on EM IX, we always have a flare-up of interest in this stock.

Years ago, our Pomology Department concluded that a full dwarf tree was of no value for commercial orchards in Massachusetts.

During the last 10 years, however, there has been a trend to orchards of small trees planted at high densities with a few plantings on EM IX rootstock. None of the growers who have used EM IX are particularly happy with this stock, however, even where the trees have been trellised and vegetation has been controlled by cultivation and/or herbicides.

In one of our more recent plantings on EM IX, the trees were budded 15-18 inches in height in hope that staking or trellising would not be necessary. Unfortunately, the grower still found it necessary to trellis the trees for stabilization.

Tree spacing and fruit quality. Fifty years ago, many orchardists failed to maintain productivity and fruit quality in blocks spaced 20 x 20 feet. Statements that follow, by James Ballard, Yakima County Extension Agent, Yakima, Washington, in Proceedings of the Ohio Horticultural Society, 1969, indicate that the present generation of growers has the same difficulty. "There are still those seedling-minded growers who think in terms of the single tree concept. He planted 20 x 20 with the idea of pulling trees on the diagonal. Then came 'Mold and Hold' and he is trying to keep these trees at 20 x 20. The theme of the North Central Washington Summer Hort Tour in 1967, emphasized the failing of this concept. The vigorous, crowded trees have complicated the grower's production tasks and at the same time reduced his extra fancy pack-out percentage."

The same problems can occur with trees on size-controlling rootstocks because of inadequate spacing. Plantings with close tree spacings will prove successful only if growers are willing and able to devote the time to the numerous details required for growing high quality fruits in high density plantings. In the future, some may regret their close tree spacings --- 7 to 12' apart in the row --- for McIntosh and Delicious on Em VII or MM 106 because high quality fruit is even more essential than high yields. High quality fruits are not grown on poorly pruned trees with inadequate light for maximum tree performance.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE

MR. RADIE H. BUNN FN
COLLEGE OF AGRICULTURE, RM. 211
STOCKBRIDGE HALL

01002

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences

Cooperative Extension Service

College of Agriculture

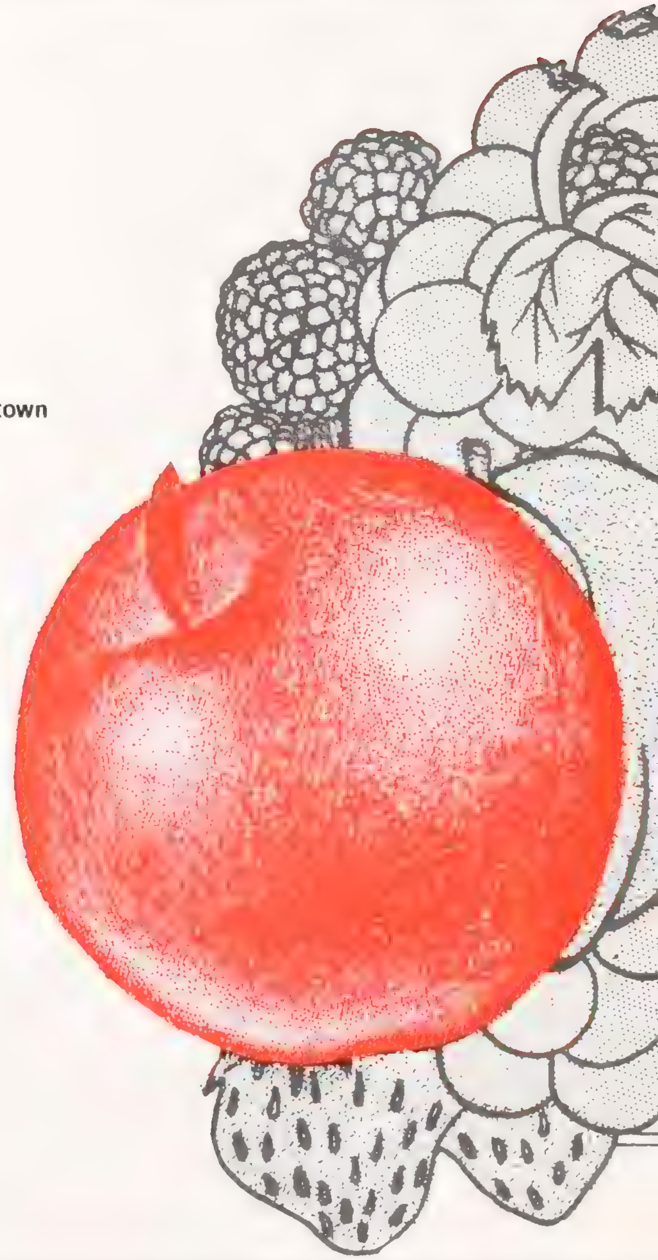
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

Vol. 37 (No. 1)
JANUARY–FEBRUARY, 1972

TABLE OF CONTENTS



Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

ATLANTIC CITY, NEW JERSEY
1972 NATIONAL PEACH COUNCIL CONVENTION
FEBRUARY 20-23, 1972

Atlantic City, New Jersey, well known for the "Miss America," summer fun and their eighth wonder of the world - the famous boardwalks, will host peach growers February 20-23, 1972, when the National Peach Council Convention convenes.

The meeting will be held at the Shelburne Hotel where ample meeting, lodging and dining facilities are available.

"Planning for Profit" is the theme for the 31st meeting of the organization. New ideas in production, marketing, promotion, and financing the peach growing operations will highlight the program.

Experts across the nation will discuss promotion on the farm, retailing methods, mechanical harvesting, outlook, farm labor and future marketing methods.

A tour through Southern New Jersey is scheduled for Sunday afternoon, February 20.

An active ladies program is planned. Visits to historic sites, walking tours in Atlantic City and several meetings are scheduled to coincide with the National Peach Council Meetings during the 3-day program.

Anyone interested in the peach industry is invited to attend. Full details and requests can be obtained through Mr. Fred Perkins, General Chairman, Rutgers University, Nichol Avenue, New Brunswick, New Jersey 08903.

****

Misnamed Trees at
Horticultural Research Center, Belchertown

One of the major problems encountered in our variety evaluation program is that of misnamed trees. The problem is most acute in our peach testing program, where we have had instances where up to 25% of the trees of one variety were not true-to-name and in other instances we have had a complete substitution for the variety. This could lead to an inaccurate evaluation of a variety. I am sure that this is also a problem in commercial orchards.

****

VARIETIES OF PEACHES FOR MASSACHUSETTS

J.F. Anderson
Department of Plant and Soil Sciences

Variety	Recommended for	Flesh color	Harvest date*
Collins	T	Y	-46
Sunrise	C	Y	-44
Erly-Red-Fre	C + H	W	-42
Sunhaven	C	Y	-40
Sunshine	T	Y	-34
Jerseyland	C + H	Y	-32
Raritan Rose	C + H	W	-31
Redhaven	C + H	Y	-28
Goldgem	C	Y	-24
Triogem	C + H	Y	-23
Sunhigh	C	Y	-18
Summerqueen	T	Y	-18
Halehaven	C + H	Y	-16
Richhaven	C	Y	-16
Redqueen	T	Y	-14
Madison	T	Y	- 7
Cresthaven	T	Y	- 7
Elberta	C	Y	0

T - Trial
H - Home Garden
C - Commercial
Varieties so marked are not necessarily equally adapted to all sections of the state.

Y - Yellow flesh
W - White flesh

*- - Days before Elberta
Elberta about 9/15.

Variety Notes

Collins

A firm medium-sized, yellow-fleshed peach. Semi-cling when picked for maximum shipping condition and a freestone when fully mature. The tree is bud-hardy, vigorous and productive.

Sunrise

An attractive, yellow-fleshed peach of good quality for its season. The pit clings unless tree ripe. Sunrise is average in bud hardiness.

Erly-Red-Fre

An attractive, freestone, white-fleshed peach of medium to large size. The flavor is excellent. The tree is vigorous and above average in bud hardiness.

Sunhaven

An attractive,, highly colored peach of good quality. The fruit is variable in size, medium to large. The tree is productive and above average in bud hardiness.

Sunshine

A highly colored, attractive, yellow-fleshed freestone. The tree is vigorous and medium in bud hardiness.

Jerseyland

The fruit is large, firm, juicy, freestone and of good flavor. The tree is large, upright and very productive. Bud hardiness is above average.

Raritan Rose

The fruit is large, round, attractive. The flesh is white, firm and juicy. The tree is large, upright-spreading and productive. The bud hardiness is above average.

Redhaven

The medium-sized fruit is highly colored, attractive and has firm flesh and fair flavor. The tree is very productive and requires heavy thinning.

Goldgem

This large, yellow-fleshed peach has good quality and firmness. The buds are above average in hardiness and the tree has been productive.

Triogem

The fruit is medium to large and well-colored. The flesh is smooth, firm and has very good flavor. The tree is medium to large, fairly vigorous and productive. The buds are of average hardiness.

Sunhigh

The fruit is large, highly colored, freestone and the flesh firm with excellent flavor. The tree is medium in size, productive and susceptible to bacterial spot.

Summerqueen

A large,attractive, yellow-fleshed peach of excellent quality. The trees are vigorous, productive and the fruit buds are above average in hardiness. The flowers require cross-pollination. Summerqueen is said to be more resistant to bacterial spot than Sunhigh.

Halehaven

The fruit is medium to large, attractive and freestone. The flesh is firm and of good flavor. The tree is large, productive and bud hardy.

Richhaven

A large, attractive, highly colored freestone of very good quality. The tree is large, vigorous and productive. Bud hardiness is above average.

Redqueen

A large, well-colored peach of good quality. The tree is vigorous and quite productive. Bud hardiness has been above average in our trials.

Madison

A highly colored, attractive peach with short pubescence. The flesh is yellow, firm, juicy and has a good flavor. This variety sets very heavy crops and requires heavy thinning to maintain medium size.

Cresthaven

This relatively new Michigan variety has not been tested in our orchards, but is recommended for trial on basis of performance in other areas. Cresthaven is described as a large, dark red, blushed peach, oblate in shape. The flesh is firm, juicy, slightly fibrous in texture, and is bright yellow with some red at the pit. The quality is very good. The tree is vigorous, productive and medium in hardiness.

Elberta

The fruit is large, fairly attractive and a freestone. The flesh is firm, juicy and has fair flavor. The tree is large, vigorous and productive. Elberta has wide soil and climatic adaptability.

****

PEACH FLOWER BUD SURVIVAL 1970-71

J.F. Anderson
Department of Plant and Soil Sciences

As part of our peach variety evaluation program, an estimate of flower bud survival for the various varieties under test at the Horticultural Research Center was made just prior to bloom in May 1971. Results to the nearest 5% are given below.

Variety	Flower bud survival %	Variety	Flower bud survival %
Reliance	90	Fowler	50
Dawne	80	Raritan Rose	50
Madison	75	Redwin	50
Redqueen	70	Sunshine	45
Collins	65	Redcrest	40
Golden Dawn	65	Sunrise	40
Goldgem	65	Triogem	40
Halehaven	65	Jefferson	20
Redhaven	65	Jerseyqueen	20
Sunhaven	65	Washington	15
Rio-Oso-Gem	60	Blake	10
Summerqueen	55	Kimbo	10

****

EARLY RIPENING APPLE VARIETIES - 1971

J.F. Anderson
Department of Plant and Soil Sciences

This is an up-date on a previous report on the early-ripening apple varieties under test at the Horticultural Research Center.

<u>Julyred</u>

This New Jersey introduction has been harvested during the first week of August in the last three seasons. The fruits are of medium size, medium red and have a bright, smooth finish. The eating quality was very good for an apple of this season. The handling and keeping qualities are very good. Julyred appears to be very promising.

<u>New Jersey #36</u>

This New Jersey introduction ripens in late July and early August. The fruit is very attractive with a bright, smooth finish and medium red color. This selection has been at least equal to Julyred in our trials.

<u>Tydeman's Early (Tydeman's Red)</u>

An English variety from a cross of McIntosh and Worcester Pearmain. This variety, ripening in late August, is similar to McIntosh in appearance, but is said to average larger in size. The apples have a green undercolor and are overlaid with a medium-red blush. The fruit has good quality and looks promising for the early fall trade. Tydeman's Early has a habit of growth similar to Rome.

<u>Paulared</u>

A recent introduction ripening with Tydeman's. The fruits of Paulared are of medium size, roundish-oblate shape and have a bright smooth finish and good red color. Our limited experience, 1970 and 1971 only, suggests that Paulared is worthy of trial.

<u>Niagara</u>

This introduction from New York ripens about 10 days before McIntosh in shape and color, but the fruit from our young trees have tended to be larger in size. The finish has been less than satisfactory in past seasons. The fruit seems more susceptible to russeting and the dots or lenticels have tended to be larger and blurred. Reports on Niagara from other sources have been more favorable and our poor response may be due to local conditions. The quality of Niagara is very good and it has been well received by those who have tried it here at the University.

****

IMPORTANT INSECT PESTS OF MASSACHUSETTS CULTIVATED BLUEBERRIES

William E. Tomlinson, Jr.
Cranberry Experiment Station, East Wareham

There are a few insect pests of cultivated blueberries in Massachusetts that are important in most seasons, and others that build up to damaging proportions only occasionally if at all. Some will warrant insecticide applications for control, others may not. Growers should be familiar with the different pests and their potential for harm in order to know what course of action to take. For the most up-to-date control recommendations, refer to the Cultivated Blueberry Pest Chart which is revised each year.

During the pruning operation in late winter and spring, be sure to remove and destroy any insect stem galls that are present. This is a pest of certain varieties more than others and can cause serious reduction in fruiting shoots on the Jersey variety and some others. If the removal is reasonably thorough and performed every year, any injury it causes will be very minor. There is no insecticidal control known for this pest.

Several species of scale insects infest blueberry. As a rule, old rough-barked canes are most seriously attacked and are the source of infestations that spread to the younger parts of the bush. Systematic removal of some of the older canes during pruning each year is not only a good pruning procedure, but it will help prevent scale build-up in a planting. If, however, scales do become serious, a dormant or delayed dormant superior oil spray before growth starts in the spring, or malathion sprays when crawlers hatch in early June, will control them.

Also, during the pruning operation be on the watch for evidences of blueberry stem borer attack. Though infested canes should be removed below any signs of boring whenever noticed, be on the watch for their characteristic, elongated, orange-colored excrement pellets under infested canes when pruning. Locate the cane that is being attacked and remove it. If the borer is farther down in the crown, probe for it with a wire or slender twig to be sure it is killed.

After the fruit buds swell but before the blossoms open, check for the presence of cranberry weevil and currant fruit weevil on bushes near the edge of the planting on quiet, warm sunny days. These are both long snouted beetles only about 1/16 inch long. The cranberry weevil is dark reddish-brown with a few scattered white scales on the wing covers, whereas the currant fruit weevil is a uniform light reddish-brown color. The cranberry weevils feed on and lay eggs in the unopened blossoms within which the grub hatches and feeds. The currant fruit weevil feeds on the small

fruit and stems of the fruit where the eggs are laid. When the eggs hatch the grubs tunnel into the berry and feed in the developing fruit. Currant fruit weevil grubs are frequently still present in small shrivelled fruit in early pickings.

In spite of their small size, both of these weevils can and often do cause serious crop losses. Once an infestation of either one becomes established in a field it is likely to persist and increase in severity year after year until control measures are applied.

Two applications of methoxychlor or Guthion, the first when weevils are first found and repeated once before opening of bloom, controls both.

As soon as the blossoms begin to drop and berries begin to enlarge, they are subject to attack by cranberry fruitworm, cherry fruitworm, plum curculio and currant fruit weevils if the last was not controlled earlier.

Plum curculio is a rough sculptured snout beetle about a quarter of an inch long, mottled with dark brown, black, yellow and white scales. Though its crescent shaped oviposition scar is occasionally noticed on blueberries in Massachusetts, it is not serious enough here to require spraying for it alone as it sometimes is in New Jersey and North Carolina.

Cranberry fruitworm and cherry fruitworm often seriously attack the green immature blueberry fruit in Massachusetts plantings. Their relative importance varies from field to field and from year to year. Usually both are present, but often only one is abundant for a period of years only to be replaced in importance by the other.

The feeding of cranberry fruitworm is the more obvious of the two because of the frassy web it makes as it feeds in a cluster of berries. Each cranberry fruitworm destroys half a dozen or more berries before it finishes feeding. The caterpillar is green until nearly mature when it becomes tinged with red on the back and sides. When mature, the worm is close to 1/2 inch long. When through feeding, the worm drops to the ground and spins an oval cocoon of sand, plant debris and silk at or close to the soil surface. The winter is spent in the larval stage in the cocoon and pupation occurs in the spring. Moths are in flight when the berries are setting and growing.

The moths have a wing expanse of about 3/4 of an inch. The forewings are dark gray above with a slight pinkish tinge and with a basal and median white area, the latter one with two black dots. The moths fly in the evening. They lay their eggs in the calyx of the berry.

In about 5 days, the egg hatches and the worm enters a fruit and commences to feed therein until the entire seeds and flesh are consumed and nothing is left but a skin full of worm castings. This procedure is repeated in as many berries as are necessary for completion of larval development which may be most of the berries in a cluster.

The cherry fruitworm feeds in the berries but makes no obvious webbing so that often premature coloring is the first sign the grower notices of their presence. Each worm feeds in 2 or 3 berries before reaching maturity. They can, however, make up in numbers for their smaller size and appetites. In very severe infestations, as many as 75 worms have emerged from a pint of berries and 2 or 3 dozen per pint is not uncommon in heavy infestations. The cherry fruitworm is a bright orange-red color and is about 1/3 inch long when mature. When through feeding, the worm has the habit of boring into old pruning stubs or dried weed stalks near the bush where it hibernates till spring when it pupates and transforms into a small black moth with a wing expanse of about 3/8 of an inch.

The cherry fruitworm moth's peak flight is during the same period as that of the cranberry fruitworm moth--toward the end of bloom and shortly thereafter, when there is an abundance of small fruit on which to feed. Eggs are laid singly on berries and on leaves near berry clusters.

Control of the two fruitworms is obtained by two or three applications of malathion, carbaryl or Guthion at 7 to 10 day intervals beginning toward the close of bloom.

See the July-August, 1971, Fruit Notes for the habits and control of blueberry maggot.

In areas of large Japanese beetle populations, they may cause considerable injury to ripening blueberries. They often congregate in large numbers on top berry clusters and feed on the berries. Scored berries shrivel rapidly and are worthless. To control them, apply carbaryl spray or dust as necessary.

Also troublesome from time to time are Datana worms. The worms feed in colonies of several dozen individuals and when they become large they strip the foliage from a branch or a small bush (it seems, overnight). When disturbed, Datana worms raise their heads and anal segments in a characteristic alert pose. The full-grown worm is about 2 inches long with a dark head and body, a yellowish "neck" and longitudinal yellowish stripes on the body.

Another worm with a colonial habit is the fall webworm. These caterpillars spin a white web as they move about and completely enclose their feeding area. The mature larva is about an inch long, pale yellow with a smoky stripe down the back and a yellowish stripe along the sides. The body is covered with white to reddish hairs.

The easiest way to control both Datana and fall webworms is to remove the colony of worms and destroy it. Don't waste insecticides on them. A heavy foot works very well here.

<u>Spittlebugs</u> and <u>plant bugs</u> are minor pests that are controlled by fruitworm sprays or other sprays used in a cared for planting.

The sharp-nosed leafhopper, which spreads blueberry stunt disease, is important if not controlled in a field where stunt is present, but the fruitworm and maggot applications keep it subdued in fields sprayed for any of these other pests.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

—

Official Business

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE

U.S. MAIL

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

Vol. 37 (No. 2)
MARCH–APRIL, 1972

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

BITTER PIT AND SIMILAR FRUIT SPOTS[1]

George E. Mattus, Horticulture Dept.
VPI and State University, Blacksburg, Va.

Bitter pit has long been a disorder in the apple growing areas of the world but pitting seems to be more of a problem today in the U.S. on varieties that once had less bitter pit.

Cork spot, a problem in Yorks for many years, has in recent years become a problem in Red Delicious and occasionally on other varieties in the Cumberland-Shenandoah apple growing area.

Bitter Pit

Bitter pit is evident as small, brown, soft, dried pits of collapsed tissue. Most of the pitting is just beneath the apple skin and primarily in the blossom half of the apple.

Although some bitter pit develops in the orchard before picking (tree pit), in the Virginia area most of the pit develops after harvest (storage pit).

One current view is that low calcium in the peel area of apples results in bitter pit although there are many complex interrelationships.

The question arises as to the causes of the increased incidence of bitter pit in recent years.

We are no longer coating leaves with calcium as we did with lime used in many spray combinations years ago. Today's red sports can be grown at higher nitrogen and higher vigor levels and still develop good red color. With higher nitrogen and more vigor, there tends to be lower calcium in the fruit and increased bitter pit. Also, present day orchards have more young bearing trees which develop more pit than older trees. Bigger and better leaf surface than in the "old days" provides more fruit shading and more leaf competition for available calcium in the tree. Earlier red color of apples with improved red sports and use of scald inhibitors now permits earlier picking for storage which results in an increased amount of bitter pit.

A listing of factors that may influence the incidence of bitter pit should help in considering the inter-relationships that may relate to this disorder. The simplified general trends of factors are indicated below according to the world-wide results up to 1971 in the view of this author.

---

[1]Excerpts from an article that appeared in Vol. 52 of Horticultural News published by the N.J. State Horticultural Society, Sept., 1971.

A. THE TREE AND FRUIT

Factor	Bitter Pit
1. Variety	effects severity
2. Sport	may be influenced
3. Rootstock	may be influenced
4. Root injury	increased
5. Young trees	increased
6. Vigorous trees	increased
7. Light crops	increased
8. Off-year-crop	increased
9. High leaf/fruit ratio	increased
10. Defoliation	decreased
11. Injured foliage	decreased
12. Larger fruit	increased
13. Russeted fruit	decreased
14. Side fruits in cluster	increased

B. THE WEATHER AND ATMOSPHERE

Factor	Bitter Pit
1. Late rainfall	increased
2. Fluctuating moisture	increased?
3. Low relative humidity	increased?
4. High temperatures	increased?
5. Excessive transpiration	increased
6. Ultraviolet rays	?
7. Air pollution	?

C. CULTURAL PRACTICES

Factor	Bitter Pit
1. Heavy pruning	increased
2. Summer pruning	decreased
3. Fruit thinning	increased
4. Delayed thinning	less increase
5. Ringing	increased
6. Late irrigation	increased
7. Overtree sprinklers	may be decreased

D. SOIL AND NUTRITION

Factor	Bitter Pit
1. Wet or dry soil	increased
2. Low pH	increased
3. Adequate lime	may decrease
4. Low calcium (Ca)	increased
5. Excess N	increased
6. High N/Ca	increased
7. High K or K/Ca	increased
8. High Mg or Mg/Ca	increased
9. High P	increased?

Factor	Bitter Pit
10. Excess micro elements	may be increased
11. Low B	may be increased
12. Adequate B	no effect
13. Excess B	increased
14. Ammonium sulphate	may be increased
15. Ammonium nitrate	may be increased
16. Urea	no direct increase
17. Sodium nitrate	no direct increase
18. Calcium nitrate	may be decreased?

E. SPRAYS AND CHEMICALS

Factor	Bitter Pit
1. Calcium nitrate sprays	decreased
2. Calcium salts	decreased
3. Nutra-Phos 24 sprays	some decrease
4. Soluble boron sprays	no decrease
5. TIBA spray	greatly increased
6. Alar spray	slight decrease
7. DPA spray	slight decrease
8. Insecticides	?
9. Fungicides	?
10. Wetting agents	?
11. Herbicides	?
12. Anti-transpirants	may be decreased?
13. Some hormones	may be decreased
14. Calcium chloride dip	may be decreased

F. HARVESTING AND HANDLING

Factor	Bitter Pit
1. Early harvesting	greatly increased
2. Delayed storage	hastened
3. Waxing before storage	delayed
4. Marketing without storage	decreased
5. Slow storage cooling	hastened
6. High storage humidity	delayed
7. CA storage	delayed

Fruit blocks with a history of bitter pit need modifications in cultural and handling practices. Reduce use of nitrogen fertilization, reduce heavy pruning, reduce fruit thinning, encourage heavier crops, do not harvest early, market immediately without storage or store for 2 to 3 months to be able to sort out bitter pit before packing for shipment.

Bitter pit development may to a large measure be most directly due to low calcium in the peel area of apples. It is very difficult to increase the calcium supply to the fruit. In the Virginia area, the current single best method of increasing calcium in the

peel area of the apple and decreasing bitter pit after harvest is by the use of calcium nitrate sprays before harvest.

Bitter pit tests in Virginia over the past 10 years are shown in the following table.

% BITTER PIT

Year	Check	Calcium Nitrate Sprayed	% Reduction of Bitter Pit
1961	10.0	0.4	96
1962	31.4	1.8	94
1963	12.4	7.7	38
1965	18.6	9.4	50
1967	11.9	6.6	45
1968	3.0	0.6	80
1969	0.5	0.2	60
1970	17.1	8.5	50
Average	13.1	4.4	66

Cork Spot

To help characterize cork spot, we might look at how cork spot differs from bitter pit in the Virginia area.

Cork spot develops during the growing season and is always present at harvest time while bitter pit is initiated during the growing season but pitting usually develops after harvest.

Cork spots are small to large brown spots located near the surface or deep in the flesh while bitter pits are small, usually just below the surface and mostly present in the blossom end of the apple.

Cork spots are harder than the surrounding flesh while bitter pits are softer than the flesh.

Evidence of cork spots start to appear in our area in July but may develop up to harvest. Some severe cork spotted fruits may drop before normal harvest.

In addition to cork spot of the York variety, at times called York Spot, cork spot has been a problem in some seasons on Red Delicious and to a lesser extent on Golden Delicious and Stayman in our area.

Cork spot may be virus related but bitter pit is probably not.

Many of the factors that increase bitter pit also appear to influence cork spot in a similar manner.

****

CORK SPOT OF DELICIOUS AND SUGGESTIONS FOR ITS POSSIBLE REDUCTION

W.J. Lord, Mack Drake and J.H. Baker
Department of Plant and Soil Sciences

Bitter pit has long been a problem in Massachusetts, particularly on Baldwin and Northern Spy. Of the varieties now commercially important, Cortland appears to be the only one on which bitter pit is of major concern. However, cork spot is a disorder similar to bitter pit. It was evident this past season that cork spot can be a serious problem on Red Delicious. Because a large number of young Delicious trees are now coming into production and because of the high market value of their fruit, this disorder could take on major economic significance.

Cork spot of Red Delicious appears generally as large dark red or greenish indentations on the fruit at harvest. These spots are larger than bitter pit and may appear anywhere on the apple, whereas bitter pit is mostly present on the blossom end. Directly underneath these indentations is brown tissue, harder than the surrounding flesh. The firmness of these spots helps to characterize cork spot since those caused by bitter pit are softer than the flesh.

Chemical analysis of peel of Red Delicious fruit by Drs. Mack Drake and John Baker, Department of Plant and Soil Sciences, University of Massachusetts, this past season, showed that low calcium in the peel was associated with both cork spot and bitter pit.

Those of you that were in attendance at the New England Fruit meetings held on January 5 and 6, 1972, heard Drs. Drake and Miklos Faust, U.S.D.A., discuss the problems associated with increasing calcium in the fruit. (These presentations will appear in the Proceedings of the New England Fruit Meetings.) It was evident from these talks that (1) the many factors that increase bitter pit also influence cork spot; and (2) that effective control measures of both disorders are yet to be perfected. The following measures for the reduction of cork on Red Delicious were suggested.

1. Continue to apply 3 tons of limestone per acre every 2 to 3 years. Where high magnesium lime was used in the last application, the use of a more soluble high calcium lime will act more rapidly and will provide more calcium.

2. Change from ammonium nitrate or urea sources of fertilizer nitrogen to calcium nitrate. Calcium nitrate fertilizer quickly increases the level of soluble soil calcium, increases the downward movement of calcium, and raises the pH of the soil.

3. Apply a dormant spray of zinc sulfate (36%) at a dilute rate of 20 lbs per 100 gallons; do not concentrate this spray above 2X. Do not apply it within 3 or 4 days of another spray, such as oil. If a dormant spray of zinc sulfate is not applied, use a zinc-containing fungicide in 3 or 4 of the cover sprays.

4. Maintain leaf boron levels between 35-50 ppm. This can be accomplished either by soil or foliar applications of boron. Soil applications of boron (B) should be applied to orchards every 3 years. Borax is the common material used. The rates of application per tree vary with age and size. Apply 1/4 lb of fertilizer borate (high-grade - 13.6%) or its equivalent to young trees, 1/2-3/4 lb to medium age and size trees, and 3/4-1 lb to large or mature trees.

   If the soil application of boron is followed by a wet spring and summer, it may be advisable to apply 2 foliar applications of boron the following year.

   Many growers now rely on annual foliar applications of B. The usual practice is to add Solubor* to 2 sprays. Apply the first spray in late bloom and the second about 5 to 7 days later. Fertilizer grades of borax may contain grit and should not be used in a sprayer. Mature trees should receive 4 pounds of Solubor* per acre each year. Consequently, the goal is to apply about 2 pounds per acre in each of the 2 applications. For young orchards, the addition of 1/2 pound of Solubor* per 100 gallons (dilute basis) to the 2 sprays meets the B requirement of these trees. Use the same timings recommended for mature trees. Reports from New York State indicate that sprays can be concentrated up to 8X with satisfactory results.

5. Apply 3 to 5 calcium nitrate sprays at 10 day intervals starting 2 weeks after petal-fall. We suggest using calcium nitrate (fertilizer or technical grade) at the rate of 5 lbs per 100 gallons of water. A spreader or wetting agent, such as Triton B, should be used at the rate of 3 fluid ounces per 100 gallons of water.

****

*Trade name

TARNISHED PLANT BUG—ITS LIFE HISTORY AND CONTROL

G.L. Jensen
Extension Entomologist

This small brownish flattened bug is perhaps the most diversified plant feeder of all our economic pests, feeding on over 50 economic plants besides many weeds and grasses. Several vegetables, cotton, alfalfa and flowering plants are attacked as well as most deciduous and small fruits.

Fig. 1. The adult tarnished plant bug, Lygus lineolaris.

Tarnished plant bugs are distributed throughout the world and the United States. They attack the buds of fruit trees, injuring terminal shoots and fruit. As they feed, they introduce a toxic saliva into the plant which causes various sorts of injuries. The buds and developing fruit may be dwarfed and pitted as in the case of beans, strawberries, peaches, apples and pears. Peaches may also have sunken areas on the sides of the fruit which are free from down, looking as though the peach had been partly gouged when small. This injury is also called "cat-facing." A deep dimple on fully developed apples is telltale evidence of earlier feeding by plant bugs.

Tarnished plant bugs overwinter as adults under leaf litter, stones and other sheltered areas. Adult tarnished plant bugs are about 1/4 inch long, less than half as broad, flattened and oval in outline (Figure 1). They are of a general brown color with small irregular splotches of white, yellow, reddish brown, and black. Along each side of the body at the posterior third is a clear yellow triangle tipped with a small, triangular, black dot.

Tarnished plant bugs become active early in the spring and seek out the host plants. They are difficult to find because of their shy habits and protective coloration; however, one can find the bleeding buds which are evidence of their feeding. Bleeding buds show a small drop of sap which exudes from the wound caused by the plant bugs piercing mouthparts. The buds of apples and pears are attacked as soon as the green tissues are fully exposed and begin to separate in the cluster.

Among the numerous host plants, those which are near the flowering stage are preferred. Hence a continuous succession of plants are attacked as they reach the favorable stage. These pests rarely breed on fruit trees; their activities on these hosts are apparently restricted primarily to feeding.

The life cycle from egg to adult is completed in 3 to 4 weeks. In New England, there are several generations per year and the bugs may become numerous late in the season. Controls are aimed at the early overwintering forms, however, due to the nature of damage which they inflict on the young developing fruit buds.

In pear orchards where plant bugs are a problem, use Guthion* or Gardona* in the pre-blossom spray and again in the petal-fall spray. Apple trees should be treated at the late half-inch-green or up-to-pink stage with the same materials.

In the 1972 Apple Fruit Spray Guide, tarnished plant bugs were first mentioned under the pink spray; however, they can be a problem earlier if periods of high temperatures occur and treatments may be necessary through the petal-fall spray.

*Trade name

****

POMOLOGICAL PARAGRAPH

Central Leader Trees: The Extension Pomologist is of the opinion that central leader trees being advocated in other areas for high density plantings differ little from the modified central leader trees suggested for our apple orchards in Massachusetts for many years. However, there is greater emphasis on the following aspects of training young trees for high density plantings.

1. Use of mechanical devices to spread scaffold branches into a horizontal position.

2. Heading scaffold branches (removal of a portion of one-year-old wood) to stiffen them and to promote lateral growth.

3. Heading of the central leader to produce lateral growth if no lateral branching has occurred.

Our biggest challenge is maintaining a central leader on trees with size-control rootstocks because (1)being weaker growing than those on seedling roots, the presence of excessive scaffold limbs more readily stunt the growth of the leader above them and (2)early fruiting on the leader reduces its vigor and its dominance.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE

U.S.MAIL

MRS. SADIE H. BUNN FN
COLLEGE OF AGRICULTURE, RM. 211
STOCKBRIDGE HALL

01002

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

Vol. 37 (No. 3)
MAY–JUNE, 1972

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

POLLINATION IN HIGH DENSITY APPLE ORCHARDS[1]

M.D. Levin
Entomology Research Division, Agr. Res. Serv., USDA
Beltsville, Maryland

"Most of our information concerning the apicultural aspects of apple pollination has been obtained over the years with standard trees and plantings. Therefore, the recent trend to high density plantings requires us to reevaulate recommendations for supplying optimum pollination. I intend to discuss the factors affecting pollination and to point out those that are more critical in high density plantings. However, much of what we now know about pollination is as valid for high density plantings as it is for standard orchards. For example, our basic knowledge about apple trees and our understanding of the concept of compatibility are still pertinent. Our definitions of the various terms are the same:

Pollination is the transfer of pollen from the anther to the receptive surface of the stigma.

Fruiting is the development of ovarian tissue around the seeds after fertilization.

Self pollination is the transfer of pollen within the same blossom, tree or variety.

Cross pollination is the transfer of pollen from one variety to another variety.

Self-fruitful varieties do not require cross pollination.

Cross unfruitful varieties are incompatible and do not set fruit when cross pollinated.

Cross fruitful varieties are compatible and do set fruit when cross pollinated.

No attempt will be made here to review the floral biology associated with the pollination of fruit or to discuss how compatibility or cultural, environmental, or genetic factors affect pollination. These subjects are, of course, well known to most of you. Also, you all know that most apple varieties are self-unfruitful so a suitable supply of the right kinds of pollen must be provided for optimum pollination and fruitset. Over the years, a number of ways of meeting this need have evolved, the best being the interplanting of suitable varieties.

---

[1] This article appeared in The Maryland Fruit Grower, Vol 41 (No. 1) 1971.

For interplanting in standard plantings, the optimum practical ratio is 1:9, that is every third tree in every third row should be a variety that supplies an abundant volume of viable, compatible pollen in synchrony with the bloom of the main variety. This pollenizer variety should also have good marketability and have cultural and pruning requirements, chemical sensitivity, and other environmental needs that are in harmony with those of the main variety.

However, compromises over the years led to the modern system in which four rows of the main variety are normally alternated with one or two rows of pollenizer trees. From the standpoint of apiculturists, this ratio is considerably less than ideal, but the requirements of orchard management seem to have made the concession necessary. With high density plantings, the practice of planting one or two rows of pollenizers to four rows of the main variety will be even less satisfactory.

It is well documented that foraging bees tend to work up and down rows rather than across rows. We have seen this behavior pattern in many row-planted crops such as alfalfa, safflower, onion seed, and melons. When trees are planted so there is almost as much distance between those in the same row as between those in adjacent rows, the bees will move between trees somewhat independently of the row, which is usually the case in standard plantings. However, the hedgerows used in high density plantings make tree spaces between rows much greater than tree spaces within rows. Therefore, the distribution of pollenizer pollen across one or more rows may be seriously limited by the movement of the bees along the hedgerows instead of between adjacent rows. The optimum solution from the point of view of the apiculturist is to make the fourth tree in every row a pollenizer tree. However, as indicated, the choice of a pollenizer variety depends on many factors, and placing pollenizer trees and main variety trees in the same row makes some of these factors even more critical. Nevertheless, for adequate distribution of pollen, compromises in orchard management may be necessary.

Other ways exist to provide pollenizer pollen though none are quite as effective as the proper number of optimally located trees:

a. In some areas, particularly in the Northwest where average orchards are smaller, purchased pollen is sometimes applied by hand with a brush or duster.

b. Large bouquets of a suitable variety can be interspersed along rows of the main variety to provide a temporary supply of pollenizer pollen.

c. Trees at intervals within the row can be top-grafted with pollenizer varieties or pulled out and replaced with appropriate varieties.

d. Hive-entrance inserts can be used to furnish pollenizer pollen for foraging bees to distribute.

The complications, limitations, and inconveniences of the first three alternatives seem obvious. The fourth suggestion may be new to many of you. The hive-entrance insert is a device that forces outgoing forager bees to walk through a pan or trough containing live compatible pollen. The pollen is picked up by the body hairs of the bee and carried to the blossoms of the trees visited by the bees. Several versions of this device have been used over the years with varying degrees of success. However, the latest modifications have solved some crucial pollination problems. Therefore, for those of you who are interested in the details, I list some pertinent sources of information at the end of this paper.

Once the availability of a suitable supply of pollen is assured, the grower needs to consider the agents that will disseminate the pollen. Apple pollen has been found moving through the air, but wind has proved to be a negligible agent in its distribution. Therefore, insects remain the only important agents of pollinations.

When orchards are relatively small and near much uncultivated land, wild species of bees may still be important pollinators. However, in most commercial plantings, native species cannot be relied upon because their numbers fluctuate widely from year to year. Also, their natural habitats are being reduced as cultivated acreage increases, which has created a long-term downward trend in population.

Commercial orchardists must therefore almost invariably rely on honey bees for adequate pollen dispersal, and they usually do this by renting colonies from beekeepers for the period of bloom. The customary recommendation for orchards of mature standard trees is that at least 1, but preferably 2, colonies per acre be brought into the orchard at the time of 10 to 25% bloom. These colonies should be distributed in groups of 5 to 15 with the intervals between groups about 400 feet, starting about 150 feet from the edges of the orchard. Protection from wind should be provided if possible, and morning sun should reach the colonies to encourage early flight.

The same recommendations hold good for high density orchards. Bees tend to forage close to their hives, particularly in cool or windy weather, and interaction between foraging bees from different groups tends to crowd the bees closer to their hives. Therefore, groups of 5 to 15 colonies should be spaced evenly throughout the orchard to insure better distribution of pollinating foragers, especially during periods of poor weather.

Also, we know that in standard plantings of large trees, individual bees tend to limit their foraging activity to one or two trees or to adjacent sides of trees. We know that when foraging populations are high, the bees increase the size of their working area because they have to search harder and visit more flowers to obtain nectar or pollen. High foraging populations thus improve the likelihood of cross pollination, and we know that higher populations increase the number of bee-to-bee contacts, which often results in one or both bees taking a long flight to another working area, which again increases the likelihood of cross pollination. For all of these reasons, the highest practicable population of honey bees should be supplied in standard orchards and these reasons are even more important with high density orchards where the flower populations are higher and the planting patterns tend to impede cross pollination. Therefore, a minimum of 2 colonies per acre is recommended for mature high density orchards. In addition, when weather is marginal, bees tend to work the sunny protected sides of trees. If at all possible, this fact should be kept in mind when the orchard is planted; if feasible, rows should be oriented to expose both sides of the trees to equal sunlight throughout the day.

Honey bees are biologically inclined to exploit more than one source of nectar or pollen during any given period if it is at all possible. This tendency gives the colony a certain amount of insurance against the possibility that a single source might fail. However, from the orchardist's viewpoint, it merely means that some of the pollinators for which he is paying are being diverted to other nonproductive activities. The orchardist can reduce the diversion by eliminating competing bloom (primarily dandelion or mustard) wherever possible. Waiting until the fruit trees are at least 10% in bloom before bees are brought into the orchard reduces the orientation of forages to competing flowers.

Colonies used to supply pollinators should be strong enough to do a good job. Therefore, colonies worth the rental fee should have enough bees to cover at least six frames, and at least four of these frames should be more than half filled with brood (the collective name given to the three immature stages of bees - eggs, larvae and pupae). The other frames should be well furnished with reserves of food, stored pollen and honey. Also, the colony should have an actively laying queen and should have good flight activity at the entrance when weather is favorable.

Most beekeepers are conscientious and reliable and will go to great lengths to supply what they contract for. Nevertheless, it seems only good business for the orchardist to make his own evaluation of the pollinating colonies he pays for. Such an evaluation is not difficult to do, and the method can be readily and painlessly learned. Also, most beekeepers are more than willing to assist the orchardist who wants to know something about bees. References to pertinent literature are listed at the end of this article.

Much of what I have just said applies generally to pollination in standard orchards as well as to pollination in high density orchards. However, two considerations seem much more critical in high density plantings:

a. Bee foraging behavior in hedge-type plantings makes it imperative that for optimum results a source of pollenizer pollen be located in the same row as the main variety.

b. High populations of honey bees increase the size of working areas of individual bees, thus increasing the likelihood of cross pollination and providing coverage of the largest number of blossoms in the high density orchards. At least 2 good colonies per acre are therefore needed to supply the population necessary."

Suggested References

Free, J.B. 1960. The pollination of fruit trees. Bee World. 41(6 & 7):141-151; 169-186.

Jaycox, E.R. 1969. Evaluating honey bee colonies for pollination. Illinois Univ. Agr. Ext. Serv. Fruit Growing 20 (Rev.).

______ 1969. Pollen inserts for apple pollination. Illinois University Agr. Ext. Serv. Fruit Growing 22.

______ 1969. Making and using pollen inserts. Illinois Univ. Agr. Ext. Serv. Fruit Growing 23.

****

POMOLOGICAL PARAGRAPH

<u>Weed control - apple orchards.</u> Dr. O.C. Zoebisch of the DuPont Company informs us that the products "Sinbar" Terbacil Weed Killer and "Karmex" Diuron Weed Killer are to be used according to the labels at various rates depending on soil type. Neither one of them should be used in apple orchards on soil types classed as sandy, loamy sand or gravelly, nor where the organic matter is less than 1.0%.

The use of sand, gravel or quarry chips under the trees for mouse control or weed control creates an environment which, in accordance with the label, disqualifies the orchard for use of these herbicides.

****

DON'T GAMBLE ON FROST WITH STRAWBERRIES

Dominic A. Marini
Regional Fruit & Vegetable Specialist

In order to obtain top yields of strawberries, you must prevent injury from spring frosts. You could do everything right - add plenty of organic matter and fertility to the soil, fumigate the soil, use disease-free plants, control weeds, insects and diseases, irrigate in dry weather, apply winter mulch - and still lose your crop or have it severely reduced by one spring frost. Frost may completely destroy blossoms, or many of the blossoms will produce "nubbins" that are small and deformed with a hard green center.

Most growers who are serious about growing strawberries are now equipped with sprinkler irrigation systems for applying water during dry periods. This same system can be used to protect strawberries from spring frosts. Strawberries have been protected from temperatures as low as 22^{o}F with irrigation.

The underlying principle of frost protection with irrigation is that heat is released as water at 32^{o}F become ice at 32^{o}F. As long as water is continually applied during the time that the air temperature is below freezing, the plant temperature remains at 32^{o}F even though it is coated with ice. Sprinklers should be turned on when the temperature at plant height drops to 33 or 34^{o}F and water should be slowly, but constantly, applied until all of the ice on the plants has melted and the air temperature has risen above freezing.

Temperatures should be watched closely when frost is a threat. Thermometers should be placed in the coldest part of the field - usually the lowest part - and the bulb of the thermometer should be at plant level, not above it or below it.

Very little water is needed to provide frost protection. As little as 50 gallons per acre per minute or one-tenth inch per hour is enough. This can be applied using number 20 Rainbird heads with a single 1/8 inch nozzle, or number 70 heads with a single 3/16 inch nozzle. Nozzle pressure may vary from 35 to 55 pounds with pump pressure at 45 to 65 pounds. Irrigation lines should be spaced 40 feet apart with nozzles 40 feet apart in a staggered pattern for complete coverage.

Spring frost is always a threat, but damage to strawberries from frost can be prevented with sprinkler irrigation. One Massachusetts grower used his sprinkler system on 13 different nights in May, 1969, and picked 17,000 quarts of strawberries per acre.

****

POLLINATION OF CULTIVATED HIGHBUSH BLUEBERRIES

William E. Tomlinson, Jr.
Cranberry Experiment Station, East Wareham

Since the beginnings of highbush blueberry cultivation, there has been considerable discussion and research concerning pollination of this crop. As early as 1910, Coville demonstrated that bees were essential for commercial set of blueberry fruit.

Phipps in Maine and Beckwith in New Jersey showed in cage tests that wind is not a factor in blueberry pollination. In tests in Michigan, Merrill proved that blueberries are self-fruitful, that is, they can pollinate themselves and that cross-pollination is not necessary for fruit set.

The relative advantages of self-pollination versus cross-pollination of blueberries were controversial for many years. The evidence accumulated by several investigators indicated that in general there was a slightly greater set from cross-pollination than from self-pollination. The most important conclusions were that cross-pollination consistently resulted in increased berry size and earlier ripening than did self-pollination.

It has been shown by several investigators that one of the factors governing size of the berries is the seed count. Since the seed count is directly related to the amount of pollination, the importance of adequate numbers of bees is apparent.

Until the blueberry acreages became quite large, pollination was seldom a problem. Wild bees in the area usually accomplished the task adequately. The introduction of new varieties and planting in large blocks of only a few varieties has more recently resulted in pollination problems. Filmer and Marucci in New Jersey found that low production of certain varieties was directly attributable to the fact that bees preferred to work the blossoms of certain varieties in a planting in preference to those of other varieties. Some of the less attractive varieties were found to be Pioneer, Stanley, Berkeley, Jersey, Earliblue, Coville, Weymouth and Concord. This reluctance of honeybees to work on less attractive varieties can be overcome by providing enough bees so that competition for forage causes them to be less critical.

Though there is no experimental evidence with highbush blueberries, it was shown by Wood in Canada that the capacity of lowbush blueberry flowers to set fruit decreases rapidly as they become older. If the same is true of highbush blossoms, it would be important to have ample numbers of pollinators present to visit all flowers soon after they open.

Probably in most Massachusetts highbush blueberry plantings, adverse weather during the blooming period is more of a hindrance

to adequate pollination than any other factor. The cool, windy and often rainy weather that frequently occurs during the blueberry blooming period can seriously curtail bee activity and result in an incomplete set even of the most attractive varieties. Therefore, as an insurance it might be wise to have hives of honeybees available to augment native wild pollinators when periods of favorable pollinating weather do occur.

Marrucci in New Jersey has recommended 2 active hives of honeybees per acre for the difficult-to-pollinate varieties - Earliblue, Coville, Berkeley, Stanley, Pioneer and Concord; one hive per acre for Weymouth, which is moderately attractive; and one hive per two acres for the attractive varieties Rubel, Rancocas, June, Burlington, Blueray and Bluecrop.

****

LEAF ANALYSIS OF PEAR ORCHARDS IN 1971

William J. Lord and Edward Vlach[1]

Scorch of pear tree foliage (Figure 1) was much less severe this past summer than in 1970 and leaf analyses supported data obtained in 1970 which indicated that magnesium deficiency is not the cause of the disorder.

Fig. 1. Pear leaves showing scorch. The light colored areas are normal tissue and the picture shows there is no pattern of scorch development. The leaves frequently become completely blackened. (Photo by L.J. Musante)

Potassium (K) level of pear leaves ranged from 0.58 to 1.39% in several orchards sampled this past summer. Since limited data suggest that pear and apple trees have similar levels of K and the desirable range for this element in apple leaves is 1.25-1.60%, we believe that K is extremely low in some of our pear orchards. The primary symptom of K deficiency is marginal leaf scorch appearing first on older leaves on spurs and shoots. The marginal

[1] Extension Pomologist, and Senior Chemist - W. Experiment Station, respectively

leaf scorch on pear is almost black in comparison to ash gray marginal coloration of K-deficient apple foliage.

We now believe that pear psylla are frequently associated with the scorch of pear foliage because of their presence on the leaves having the disorder in 1970 and 1971. Honeydew secreted by these insects adheres to the foliage and a sooty fungus grows in it. The foliage with the sooty fungus is injured.

****

MANGANESE DEFICIENCY

William J. Lord and John H. Baker
Department of Plant and Soil Sciences

This past summer we observed, for the first time, what appeared to be manganese (Mn) deficiency in several apple orchards and one peach orchard. Leaves had interveinal fading of chlorophyll, starting at the leaf margin and extending towards the mid rib (Fig. 1). To verify our observations, leaves from McIntosh apple trees in 3 orchards were analyzed and their Mn content was found to range from 9 to 14 ppm. Mn levels of this magnitude are critically low in comparison to the desired standard of 50-100 ppm set by other states for apple trees.

Fig. 1. McIntosh apple leaf showing Mn deficiency. Note the interveinal fading of chlorophyll with the veins remaining green. (Photo by L.J. Musante)

The peach orchard also was low in Mn. Leaves from trees showing the deficiency symptoms had 13 ppm Mn in comparison to 97 ppm in leaves from trees with no interveinal loss of chlorophyll.

Mn deficiency can be corrected by foliar applications of manganese sulfate or of a fungicide containing Mn. For apples, Dr.

Warren Stiles in Maine recommends that manganese sulfate be applied about first cover at a rate of 3 lbs. per 100 gallons. If using a Mn-containing fungicide, 2 or 3 applications are necessary with timings about petal fall, first and second cover. Research findings in other areas indicate that recommendations for correcting Mn deficiency in apple trees should also be effective for peach trees.

****

PROBLEM WEEDS IN APPLE ORCHARDS AND THEIR CONTROL

William J. Lord
Department of Plant and Soil Sciences

Although we have several good herbicides available for use in apple orchards, certain perennial broadleaf weeds such as dandelions, poison ivy, milkweed, trailing black berries and morning glory have become a problem where chemical weed control is practiced. These weeds may have been present before the use of herbicides, but the chemical control of the more susceptible weeds has made conditions more favorable for their growth and allowed them to become more serious problems. Because of herbicide usage for the control of perennial grasses, we also have encountered an increasing problem with some annual grasses, namely, crabgrass, foxtail, fall panicum and barnyard grass, which invade the weed-free areas in mid- and late-summer. For those of you concerned with one or more of the problem weeds mentioned above, we have prepared below our suggestions for their control.

Table 1. Problem Weeds in Apple Orchards and Their Control

Problem Weed	Herbicide to Use	Remarks
	Perennial Broadleaf Weeds	
Brambles	Ammate X*	Contrary to some reports, we have found that 2 applications of Weedone 638* in the same season failed to control brambles.
Poison ivy	Ammate X*	Weedone 638*, Dacamine* or Dacamine 4D* would be a second choice
Dandelions, Dock Bindweed, Plantain, and Sorrel	2,4-D formulations - Dacamine*, Dacamine 4D* or Weedone 638*	Optimum time of application will vary with weed species.

*Trade name

Problem Weed	Herbicide to Use	Remarks
Milkweed	Ammate X*	Terbacil or repeat application of paraquat or one of the 2,4-D formulations mentioned above may be somewhat effective.
	Annual Grassy Weeds	
Barnyard grass, Crabgrass, Yellow Foxtail and Witchgrass	Terbacil	These weeds often invade herbicide-treated areas by August. Following the emergence of these weeds, an application of paraquat may keep the treated areas practically weed-free for the remainder of the season.
	Annual Broadleaf Weeds	
Lambsquarters and Ragweed	2,4-D formulations	Same as above

*Trade name

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

JULY–AUGUST, 1972

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

MARKETING AGREEMENTS AND ORDERS FOR APPLES

Norman C. Healey, Chief[1]
Fruit Branch, Fruit & Vegetable Div.
USDA Consumer & Marketing Service
Washington, D.C.

Today, farmers are taking a good hard look at how to bring about more order in marketing their commodities. This is evidenced by the interest shown in cooperative marketing -- one desk selling --the merging of cooperative organizations both laterally and vertically. There is a continuing interest in Bargaining Associations to develop market muscle or power in selling their products to processors. State and Federal Marketing Agreements and Orders are another tool in bringing about more orderly marketing.

I would like to take a moment and read you a statement made by Dr. William Black, Economist at the Texas Agricultural Experiment Station at the National Agricultural Marketing Conference about a year ago, which, I think, has a lot of meat in it---

"In the future, farmers will polarize their farming operations around their marketing program. The farmers' economic programs will be more dependent upon what happens off the farm than on the farm. Off the farm, the farmer will find the marketing arrangement needed to secure a "home" for his product and to obtain adequate production financing: join a coop marketing organization or bargaining organization, or integrate as part of a marketing organization. For farmers who do not belong to their own organization, there will be one of three choices, (1) become part of a food distributor or food processor's backward integration complex, (2) market their own products through a sandwich market or other retail outlet, (3) drop out of farming. Producers will lose the right to produce what they please, when they please, where they please, how they please and still make a profit. Producers will not be able to stand apart from organized marketing and stay in business."

In my field particularly, we are seeing more interest on the part of fruit growers in getting together to develop marketing agreement and order programs both at the Federal level covering an area of more than one state, or state marketing orders, for the purpose of developing and expanding the market for their commodities.

I would like to give you a "bird's eye" view of Federal marketing agreement and order programs.

1. First, I will point to the legislative authority for marketing agreement programs.
2. The scope of Federal marketing agreement programs.
3. How to get a Federal marketing order
4. The types of regulation under a program.

---

1 Presented at the Nashoba Fruit Producers School held at Harvard, Mass., March 6, 1972

5. And lastly, what a Federal marketing order can do and what it cannot do for you.

Legislative authority

Federal marketing agreements and orders are authorized under the Agricultural Marketing Agreement Act of 1937, as amended. Under this act, it is the declared policy of the Congress to establish and maintain such orderly marketing conditions for agricultural commodities as will improve returns to growers and will be in the public interest.

Scope of programs

Marketing agreements and orders have been used by fruit, vegetable, and nut producers since inception of the act. The number of programs has grown rather steadily over the years. Today, we have 49 marketing agreements and orders on 33 different fruit and vegetable commodities with a farm value of about one and three quarter billion dollars in areas covering 34 states. The programs are administered in the Fruit and Vegetable Division in the Consumer and Marketing Service in USDA.

There often is some confusion over "marketing agreements" and "marketing orders" which I would like to clear up at this time. Marketing agreements are contracts between parties signing them and the USDA, and are binding only on those who sign them. Marketing orders, however, apply equally to everyone in the industry. I will use the term "marketing order program" to cover both the agreement and the order.

Obtaining a Federal marketing order

The objective of marketing order programs is to bring about more orderly marketing conditions for a commodity and thereby get more money for the producer. These programs do not just happen--there is a lot of thought, discussion, and good hard work that goes into a program before it is adopted. First, there has to be substantial agreement in an industry that a marketing order is needed to help solve some of its marketing problems. The marketing problem should first be defined, then the growers and shippers should sit down and design or draw up a proposed marketing order which will meet their needs. Then, after thorough discussion and with substantial support of the majority of the growers in the area to be covered, they may request the Secretary of Agriculture to hold a hearing.

1. If he agrees there appears to be a need for such a program, he will call a public hearing on the proposal. All interested persons may appear to testify at the hearing on the proposed program, the need for it, how it will operate and what they expect to accomplish by it. Testimony from both proponents and opponents will be heard.

2. After the conclusion of the hearing, a time will be given for interested persons to file briefs recommending proposed findings and conclusions based on testimony presented at the hearing.

3. A recommended decision is published by the Department based upon the hearing record and the briefs filed. Here again, interested parties are given a period of time in which to file exceptions to the recommended decision.

4. The final decision is issued by the Department based upon the hearing records, briefs, and exceptions to the recommended decision. This decision includes the order, if any is recommended, as a result of the proceedings.

5. After the final decision is reached, a referendum is held to determine whether or not growers favor the issuance of the order. A marketing order cannot be issued unless two-thirds of the growers voting in the referendum approve it. At the same time, a companion marketing agreement is submitted to handlers for their signup.

6. If the order is voted in and is issued by the Secretary of Agriculture, then the industry meets and nominates the committee which will operate the order at the local level. Each fruit and vegetable marketing order provides for such a committee.

7. The committee can now meet and recommend regulations within the framework of the order. As soon as such regulations are issued by the Secretary, they have the force and effect of law.

8. At this point, I'd like to point out how a marketing order can be terminated. First, the Secretary shall terminate an order if it is not effectuating the purpose for which it was designed. Second, the order can provide that a grower referendum be held periodically to determine whether the marketing order be continued in effect. Most orders today provide for a two, three or five year referendum. Third, the Administrative Committee or a substantial segment of the growers can request the Secretary to hold a referendum for continuance of the program at any time. In a grower referendum, if growers producing more than 50 percent of the volume of the commodity produced in the production area covered by the order, vote for termination, the order will be terminated.

<u>Types of regulations</u>

Now to the types of regulations. Most of our fruit and vegetable programs regulate <u>quality</u>. The plan here is to keep inferior grades of the commodity from depressing the market for the whole crop. This is accomplished by regulating the grades, sizes, or maturity of the commodity which can be shipped to market. These requirements can be changed during the marketing season or from season to season, depending upon changes in supply and demand conditions. Inspection is necessary to determine the quality of products marketed.

Some of our fruit and vegetable marketing order programs regulate quantity of a commodity marketed -- by rate of flow -- or by total quantity marketed during the season. Rate of flow regulations are concerned primarily with maintaining an orderly flow of the commodity moving to market during the normal marketing season. A good example of this type of regulation is our California-Arizona lemon order under which an industry committee each week recommends to the Secretary the number of carloads of lemons which should move to market each week.

Under the total seasonal type of quantity regulation, marketings are limited for the season to a specified percentage of the total crop. The residue is usually placed in a pool to be exported or utilized in some non-commercial outlet designated by the industry committee, or in the case of red tart cherries to be marketed in some subsequent season.

Some other types of regulation are container and pack regulations to standardize containers and make packs more uniform.

Marketing research and development projects designed to promote the marketing, distribution, and consumption of the commodity are also authorized. Advertising and sales promotion programs may also be included under this program if advertising authority for the particular commodity has been provided in the act. This has been done for many commodities to date.

These are the most common of the many provisions which may be included in a Federal marketing agreement and order.

As I indicated earlier, Federal marketing orders are administered by a committee of growers or both growers and shippers. Such committees are nominated by the industries concerned and appointed by the Secretary of Agriculture. The committee employs a manager and a staff to carry out the necessary day-to-day work. The expenses of the committee are financed by assessments on shippers. Many of the Federal orders cost less than a cent per box or bushel to operate.

What can a Federal marketing order do?

Marketing orders, although versatile in many respects for aiding growers in meeting their marketing problems, are not "cure-alls." THEY CAN'T CHANGE THE LAW OF SUPPLY AND DEMAND. THEY CAN'T FIX PRICES. THEY CAN'T CONTROL PRODUCTION AT THE GROWER LEVEL. THEY CAN'T MAKE GOOD FRUIT OUT OF POOR FRUIT -- AND -- THEY DON'T JUST APPLY TO THE OTHER FELLOW.

THEY CAN IMPROVE MARKETS BY MAKING THEM MORE ORDERLY MARKETS BY REGULATING THE QUALITY, GRADE, SIZE, AND MATURITY OF FRUIT MOVING TO MARKET. THEY CAN REGULATE THE VOLUME OF A COMMODITY MOVING TO THE MARKET EITHER WEEKLY OR FOR A WHOLE MARKETING SEASON. THEY CAN AFFORD GROWERS AND SHIPPERS A MEANS FOR WORKING TOGETHER TO

IMPROVE THEIR MARKET POSITION, DEVELOP VALUABLE MARKET INFORMATION THROUGH RESEARCH AND EVEN PROMOTE A PRODUCT THROUGH ADVERTISING AND PROMOTION WITH ALL SHIPPERS CONTRIBUTING THEIR SHARE OF THE COST.

Federal marketing orders are today providing growers, packers, and shippers of many fruit and vegetable commodities an opportunity to work together in efforts to increase their market power and expand their markets here at home and abroad and thus bring more order to marketing.

I want to leave you with one important thought this morning. We have nothing to sell -- we only have a service to offer. If you want to know more about it or discuss in more detail how a Federal marketing order could serve your needs, we are ready to assist you in improving your market position. These are not government programs -- they are industry programs which will require a lot of foresight and good hard work on the part of industry leaders to develop a program to fit the needs of your industry.

****

POMOLOGICAL PARAGRAPH

Raised beds for strawberries: During a meeting at a local strawberry nursery this past fall, there was considerable interest in the raised strawberry beds. Because of poor drainage, the plants were set in rows harrowed and leveled to make them several inches above the alleys that separate the rows. Even on well drained soils, raised beds are advantageous because (1) many fields have low spots where water accumulates during the growing season and (2) they facilitate water drainage resulting from winter thaw or a heavy rain on frozen ground. Root rot and Red Stele are most commonly found in plants growing on poorly drained areas and ice formation on the beds can cause extensive damage to the crowns of strawberry plants.

Some growers may recall the winter of 1958-1959 when ice on strawberry beds caused severe plant damage throughout Massachusetts and drastically reduced yields in 1959. However, the writer saw a bumper crop in Andover Massachusetts in 1959 (6,000 quarts on 18,000 sq. ft.). This grower maintained an alley 15-18 inches wide during the 1958 growing season and each time the bed was hoed, the soil was pulled around the plants so that the matted row was raised at least 3 to 4 inches above the alleys. The raised bed was probably responsible for minimizing plant damage from ice the following winter.

****

INTEGRATED PEST MANAGEMENT IN MASSACHUSETTS APPLE ORCHARDS

G.L. Jensen, E.J. Blyth and A.W. Rossi[1]
University of Massachusetts

Integrated control may be defined as an ecological approach to pest management in which several available techniques are consolidated into a unified program. Such programs are set up to avoid economic damage and minimize adverse side effects in management of pest populations.

Such a program may make use of insect parasites, predators, pathogens and biotic agents artificially increased or introduced, together with some selective pesticide applications which, when deemed necessary, would be used only in a manner that is least disruptive to these beneficial regulating factors of the environment. The traditional control programs used in most orchards rely on <u>chemicals only</u> to maintain pest populations at sub-economic levels.

Integrated control programs are desired for several reasons:
1. Plant feeding mites and, to a lesser degree, insects, very rapidly develop strains resistant to chemicals, necessitating the constant development and substitution of new chemicals.

2. Predators and parasites of many orchard pests are found to a greater or lesser degree in all fruit growing areas. The beneficial effects from these cannot be realized if they are killed by insecticides.

3. Integrated pest management systems rely on reduced spray applications, hence they help to reduce any possible environmental pollution by spray chemicals in orchards.

4. The use of reduced spray (as recommended in some integrated control programs) reduces the cash expended for chemicals and in some cases the amount of time spent in applying these materials.

5. Systems utilizing biological control tend to become increasingly more efficient from year to year as beneficial insects build up in the orchards (in contrast to chemical control programs which tend to become less effective as the pests develop resistance to insectides).

6. Biological controls have great public appeal, especially in this period of great ecological concern and awareness.

There are, however, several difficulties associated with integrating chemical and biological controls of orchard pests:

---

[1]Extension Entomologist, Graduate Student, Dept. of Entomology and Orchard Foreman, respectively.

1. Many pests of apples exist in the orchards, and must be held below economic injury levels. There are no known effective biological controls for some of these pests, hence, chemicals must be relied on to keep them in check. This must be done without eliminating the natural enemies of the pests that can be held in check with biological controls.

2. There are few insecticides which are selectively toxic, i.e., most commercially successful insecticides kill many kinds of insects. This makes the above mentioned difficulty even more acute.

3. Integrated control systems require a great amount of effort on the orchard manager's part, for he must constantly be aware of the pest and predator situation in his orchard.

4. Due to the large spectrum of insect and mite pests on apples, use of the suitable spray chemicals currently available is essential. The timing, formulating, and application of these materials must be closely supervised by the orchard manager.

Integrated Pest Control Study

The effectiveness of a modified integrated control program was tested in a 6-year-old block of McIntosh and Red Delicious apple trees at the Horticultural Research Center, Belchertown, Massachusetts in 1971. Spray applications were applied at 6X concentration with a Kinkelder mist sprayer, except for a dormant oil spray which was applied with a Hardie speed sprayer.

Half of the trees served as controls and were sprayed in the normal manner using pesticides which are reputedly the least harmful to natural enemies. The integrated portion of the block involved the alternate middle row of spraying, i.e., the rig was drawn between rows 1 and 2, 3 and 4, 5 and 6 etc., with the machine spraying from both sides. For the next application, the rig was drawn between rows 2 and 3, 4 and 5, etc. Thus, only half of each tree was sprayed during each application. This pattern of spraying supposedly provides an unsprayed haven for the parasites and predators which are generally more mobile than their prey. After spraying, the beneficial insects are able to move to the unsprayed portion of the trees and avoid being killed. As predator and parasite populations increase, fewer pesticide applications applications should be necessary.

Similar pesticides were used in both blocks, however the integrated block received only about half the quantity used in the control block due to the alternate-row spraying technique.

The trees were surveyed periodically for the presence of insect pests, parasites and predators. Both the aphid and European red mite populations built up to a peak in mid-September in the integrated block. At this time, the aphids occurred at about 3

per leaf and the mite population was about 6-8 per leaf. Populations such as these can be tolerated, especially this late in the season: moreover, a certain number of prey are required to maintain populations of beneficial insects. The plan of the integrated program is to regulate the pests below the economic level of injury, but to allow sufficient numbers to maintain adequate predator and parasite populations.

Along with the aphids and European red mites, there were several predators observed, although quantitative records were not maintained. Numerous syrphid fly (hover flies), lacewing, and ladybird beetle larvae were noted. These three are predaceous chiefly on aphids, while some species feed on mites. The presence of these predators indicated that the integrated control program was at least partially successful.

An assessment of insect and disease damage to fruit was taken by examining 4 bushels of apples of each variety from each block. Red Delicious apples exhibited no difference in the amount of damage, but McIntosh apples from the integrated trees had more damage from green fruit worm and plum curculio than those from the control trees.

Summary of Study

These results are by no means conclusive, but they do look promising. The integrating program involves about as much time as the standard spraying schedule, but it did reduce by nearly 50% the amount of pesticides needed. The integrated control program permitted an increase in the beneficial insect population but an increase in the number of pests also occurred, noticeably aphids, mites and green fruit worms.

Plans for Further Study

Further experimentation in the same block is being conducted in 1972 to examine the insect and mite population dynamics in the integrated trees as compared to control trees, together with the resulting damage in each situation.

This past winter we laboratory-reared a small, black ladybird beetle, Stethorus punctum, (see photo) and some predatory mites which are predaceous on both European red and two-spotted mites. These beetles were released in our experimental orchard this spring.

The Ladybird beetle Stethorus punctum feeding on a two-spotted Spider Mite.

The base stock of the ladybird beetles was obtained from Prof. Dean Asquith and Dr. Richard Colburn at the Fruit Research Laboratory in Biglerville, Pennsylvania. These workers have incorporated the black ladybird beetle into their integrated control program for apples in south-central Pennsylvania and have had such success that the application of miticides in some blocks has been almost eliminated. This little beetle, despite its small size (about the size of a pinhead), can eat large numbers of mites (about 300) during its life cycle from egg to adult. It also has the advantageous character of being able to rapidly develop resistance to most of the pesticides used on apples. *Stethorus punctum* and other predators could prove to be valuable assets to the integrated control programs of apples in Massachusetts.

We hope that it will be possible to produce apples with a low incidence of insect and disease blemishes while at the same time employing fewer pesticides. During the 1971 season, much injury occurred in the integrated block as a result of plum curculio and green fruit worm. Therefore, in 1972, a regular spray schedule is being used during the period critical for the control of these two pests and a reduced spray schedule will be used in the cover sprays. This should hopefully favor the predators and at the same time reduce spraying cost.

Because of the large number of pests infecting apple orchards, and the high quality fruit demanded by the consumer, it is virtually certain that some pesticides will always be necessary for apple growing. However, integrated control programs are potentially applicable to the orchardist. The dependence on chemicals can be minimized while the reliance on natural enemies of pests can be maximized. This ultimately could result in a dollar savings and a cleaner environment.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE

U.S.MAIL

MR. RADIE H. BUNN FN
COLLEGE OF AGRICULTURE, RM. 211
STOCKBRIDGE HALL

01002

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences

Cooperative Extension Service

College of Agriculture

University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

Vol. 37 (No. 5)
SEPTEMBER–OCTOBER 1972

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

SUGGESTIONS FOR USE OF ETHEPHON TO PROMOTE EARLY RED COLORING OF McINTOSH APPLES

Duane W. Greene and William J. Lord
Department of Plant and Soil Sciences

Ethephon (Ethrel*) received a temporary shipping permit (experimental label) on June 14, 1972, and will be available for trial by a limited number of growers this fall.

Ethephon loosens apples for more efficient mechanical harvesting, stimulates early red color and fruit ripening, and promotes flowering of young apple trees. At present, we will concern ourselves with its use to enhance red color development on McIntosh apples.

Ethephon, when applied alone, rapidly promotes fruit softening and accelerates drop. To help counteract these undesirable effects, the ethephon application is preceded by a mid-summer application of Alar 85* and is followed by an application of a stop-drop compound.

Our limited trial last year showed that the ethephon and stop-drop applications enhanced red color on McIntosh apples but completely eliminated the increase in flesh firmness induced by Alar 85*. Within 8 days after application of the ethephon-stop-drop combinations, McIntosh fruits from these treatments were considered unsuitable for CA storage. The abscission-promoting effect was completely overcome by 2,4,5-TP but the Alar-ethephon-NAA combination failed to reduce preharvest drop.

Based on the results cited above, we concluded that the commercial potential of ethephon appears to be limited to early fruit sales at harvest time or after a short period of cold storage.

For growers interested in using ethephon to advance red color development on McIntosh, we suggest the following procedure and combination of chemicals.

1. Use ethephon on trees that were sprayed with Alar 85* in mid-July.

2. Apply a foliar spray of ethephon at rate of 2/3 pint of the commercial material (Ethrel*) per 100 gallons of water (assuming 400 gallons of spray mixture per acre at 1X),

---

*Trade name

2. about 2 weeks before the desired harvest date. A total of 2 2/3 pints per acre should be applied.**

3. Within 2 days after the ethephon application, use a foliar spray of 2,4,5-TP at 20 ppm.

**It may be possible to enhance red color development with a lower concentration of Ethrel* and thereby reduce the loss of fruit flesh firmness. We plan to investigate the effects of lower concentrations this fall.

****

BLUE MOLD APPLE STORAGE ROT

C.J. Gilgut
Department of Plant Pathology

Blue Mold probably causes more rot of apples in storage than all the other rots together. In some years, the loss may be substantial.

The rot is caused by the fungus, *Penicillium expansum*, which attacks all parts of the apple and causes a brownish, soft, wet, mushy rot with a musty odor. It may affect part or all of the apple. At times there is some growth of white mold on the rotted surface and usually the surface is covered with bluish-green tufts which consist of masses of fungus spores. A sound apple against a rotten one becomes wet and has a musty odor. Often it also rots and this results in "pockets" of rotten apples in a box.

The blue mold fungus grows and produces an abundance of spores on all kinds of dead organic matter in shady places where it stays damp or wet. It grows on dead wood on the tree or in the orchard, on old boards and new boards, on picking boxes and crates, on rotting fruit under the tree, on rotting and mashed fruit in dump piles outside of the storage, discarded apples in boxes in the packing room and, of course, on wet boards, boxes and rotting apples in the storage.

Blue mold spores are present everywhere the fungus grows. They are air-borne and are in the air of storages and packing rooms, on room surfaces, on grading and handling equipment, on the hands of workers, in water in tanks used for fruit dumping, washing or dipping. All apples dipped in a contaminated tank will have spores on them. Blue mold spores are tough! They can live at least 2 years under dry conditions and are not killed by most fruit fungicides.

The rot affects only ripe apples or apples approaching maturity. As apples stay in storage longer, they become more mature and more susceptible and there is more rot. Rot starts from a spore which germinates on the apple and grows into the flesh. The most common places of entry early in storages are injuries or breaks in the

skin such as are caused by stem punctures, nails in boxes, insect stings, bruises in picking and handling, sun scald, chemical injury, limb rub, apple powdery mildew russet, or other rots. Entry may occur also at the stem, at the calyx end and by penetration into an open calyx canal.

Although the fungus commonly enters through an injury, it does not need a puncture or injury to enter an apple. It can enter through the lenticels, and lenticels are in fact the most common place of entry late in the storage period. Rot increases considerably after 180 days in cold storage. At that time, the lenticels are more vulnerable to entry and the flesh of the apple more mature and more susceptible to rot.

There is a relationship between temperature and the length of time it takes for rot to get started and the rate at which it grows. Development of rot is negligible at 32^{o}F even after 8 weeks in storage, by which time it may involve one-third of the apple at 41^{o}F, and the entire apple at 50^{o} or higher. Blue mold rot starts slower, and there is less of it early in storage, if apples are picked before fully mature and placed in cold storage and cooled down without delay. After 180 days in storage, low temperatures do not seem to slow it down much.

SOME THINGS A GROWER CAN DO TO REDUCE LOSS FROM BLUE MOLD

1. Obviously, if the blue mold fungus does not have something suitable on which to grow, it will not produce spores to cause storage rot. A grower can get rid of some things he does not need, outside and inside his storage and grading rooms, such as rotting wet boards, broken apple boxes, debris, trash piles and rotting apples - and do it often. In the home, this is called Good Housekeeping!

2. Kill Blue Mold Spores - Decontaminate picking baskets, picking and storage boxes, lugs, and crates, grading equipment and walls, ceilings, and floors of grading and storage rooms. (It is estimated that an old apple box may have more than 32 million blue mold spores on it). There are several ways of doing it and the method a grower selects will depend on the job that needs to be done.

   (a) Streaming Steam (Live steam) - An exposure for 2 minutes kills blue mold spores on surfaces, between boards, in cracks and joints and even in dried rotted apple tissue. It leaves no residue to offend anti-pesticide crusaders. A steam jenny is a handy thing to have around.

   (b) Sodium hypochlorite - This is the active ingredient (5.25%) in household bleach, such as Clorox and other brands, which releases available chlorine. Chlorine is used to make drinking water supplies and swimming pools safe and for other disinfecting purposes.

Sodium hypochlorite solutions are registered for use to control molds, mildews and yeasts on cannery belts; for dipping lug boxes (canneries and packing houses); in dairy, meat, and poultry processing plants; storage cellars; and storage rooms.

Sodium hypochlorite solution is extremely toxic to blue mold spores which are wet with it. Action continues for several days - until the solution dries out and the chlorine dissipates into the air. It leaves no residue to harm apples which come in contact with treated surfaces later. In blue mold control experiments at the Washington State Experiment Station, apples dipped in a 0.4% available chlorine solution (4000 ppm) were not harmed. (But, it is not registered by the Environmental Protection Agency for dipping apples.)

Apply to precleaned surfaces because it does not penetrate encrusted organic matter such as rotted apple tissue very well.

Sodium hypochlorite is registered for use by the Environmental Protection Agency as follows:

Lugs: (this would include apple boxes) "Dip empty boxes in 1600 ppm or stronger available chlorine. Do not rinse."

Storage Cellars: "For floors, ceilings, and walls, spray with 200 to 5000 ppm available chlorine solutions. Do not rinse." (Although 2000 ppm kills blue mold spores, 4000 ppm gives a little more "oomph" and is what the Washington Experiment Station suggests.)

Storage Rooms (ceilings, floors, shelves and walls): "Use 1000 to 1900 ppm available chlorine. Apply with a mop, sponge, or sprayer to precleaned surfaces. Do not rinse."

Here is how much household bleach solution containing 5.25% sodium hypochlorite to mix with water to get the ppm (parts per million available chlorine) you want.

1000 ppm-2 1/2 oz solution from jug to 1 gal water.

Want more? 1 gallon to 50 gals water.

2000 ppm - 5 oz per gal or 1 gal to about 25 of water.

(c) Formaldehyde - Commercially available as formalin which is about 37% formaldehyde dissolved in water with a little methyl alcohol added as a stabilizer.

Formaldehyde solution is drying to the skin and the vapors or fumes are irritating to mucous membranes and eyes. It is very toxic to plants and should only be used in empty storages, grading rooms or on empty containers.

Formaldehyde fumes or vapors are fungicidal and bactericidal and will kill blue mold spores as well as other storage rot fungi. The dosages given here are for the amount of formalin (the commercial 37% formaldehyde solution) to use. It may be applied as a spray or used to generate formaldehyde gas for decontamination of empty containers, storage rooms, and grading rooms. By "empty" we mean no agricultural products, plants or other forms of life, like animals. Once a squash grower asked how to disinfect a storage with formaldehyde. He did not say it was full of squash. It was assumed that the storage was empty and he was told how to do it. He ended up with a storage full of damaged squash.

As a Spray: 1 gallon of formalin to 50 gallons of water. You will need 1 pint of formalin for each 1000 cubic feet of confined space. Empty apple boxes, lugs, crates, picking baskets and equipment to be disinfected can be assembled in a pile outside where it can be covered with a plastic tarp to confine the formaldehyde fumes. In a sunny location, the tarp will trap heat and there will be better disease kill.

Wet down the pile with water - it will give better disease kill, spray with the formaldehyde solution, and cover with the tarp.

After 24 hours, the tarp can be removed or it can be left on which will delay recontamination, until a few days before the materials in the pile are to be used. The formaldehyde fumes will evaporate and dissipate in a few days after the tarp is removed and there will be no residue to harm the apples later.

Storage Rooms (with empty boxes, crates or other equipment) and Packing Rooms (with equipment and empty containers).

Wet down walls, ceilings, and materials to be decontaminated with water for better kill. Spray or wet everything down with the required amount of formaldehyde solution. You need 1 pint for each 1000 cubic feet of space to be fumigated. One gallon in 50 gallons of water will do 8000 cubic feet. The temperature of the packing room or storage room should be 65°F or higher.

Spray walls, ceilings and surfaces to be decontaminated and close the room for 24 hours. Then open and ventilate until all formaldehyde fumes are gone (You can smell them) BEFORE ENTERING or STORING PRODUCE. (More about Ventilation under "FORMALDEHYDE GAS").

As Formaldehyde Gas:

This is an easy method. Suitable for empty storage or packing rooms (no living organisms). Boxes, containers, or equipment stored in them may remain or be placed in them to be decontaminated.

Gas is generated by reacting 1 pint of formalin (the commercial 37% formaldehyde solution) with 8 ounces of potassium permanganate (crystals or powder) for each 1000 cubic feet of storage. When they are combined, there is a violent boiling action and clouds of gas, which soon penetrate all parts of the room, are released. Considerable heat is generated and there may be some spattering.

Proceed as follows:

1. Wet down walls, floors and items to be decontaminated with enough water to moisten them.

2. Room temperature $65^{o}F$ or higher.

3. Calculate cubic content of room. You will need 1 pint of formalin and 8 oz of potassium permanganate for each 1000 cubic feet.

4. You will need several large wide metal containers such as 5 gallon pails, wide pans, or even an ash barrel will do, in which to react the two materials.

5. Put 3 pints of formalin (enough for 3000 cubic feet) in a container and place the containers in different parts of the storage so that starting with the one farthest from the door you can work toward the door. On a wooden floor, place them on bricks, because considerable heat is generated.

6. Beside each container of formaldehyde place the required amount of potassium permanganate (8 ozs for each pint) in a coffee can.

Now you are ready to generate gas and fumigate.

Proceed as follows:

Starting with the container farthest from the door, carefully pour the potassium permanganate over the edge

of the container into the formalin. There will be a violent boiling and clouds of gas will come up. Do it at arms length and with the face turned away to avoid possible spattering or a face full of gas. Go without delay from one container to the next closer to the door and out. Close the door. That's it.

After 24 hours open the storage and ventilate. Do not Enter or store produce in it until there is No Trace of Formaldehyde. Formaldehyde is absorbed in water and it will continue to be released until the water and moisture in the storage is dried out and the storage is thoroughly aired.

Other things a grower can do to reduce loss from blue mold rot in storage - pick before apples are fully ripe, avoid injuries and bruises, and get them into storage and cooled down without delay.

****

BLUE MOLD APPLE STORAGE ROT, DIP TANKS AND WATER DUMPERS AND WASHERS

C.J. Gilgut
Department of Plant Pathology

Every apple box or apple with blue mold on it which is dunked or immersed in the tank leaves blue mold spores in it. By the end of the day, the tank can have quite a load. And every apple dipped in the tank will have blue mold spores and other rot spores on it which will be carried into the storage and cause rot later.

Growers have included apple fungicides in the dip solution in an effort to reduce storage rot. They doubt that it does much good when they find substantial amounts of storage rot later.

Some recent work on effect of fungicides in dip solution on storage rots by Dr. M. Szkolnik, at the New York Agricultural Experiment Station at Geneva, is of interest.

McIntosh and Cortland apples were rolled on a board with two nails projecting 3/16 of an inch to simulate stem punctures and the injured apples placed in steam sterlized boxes and dipped in the solutions. After draining, the injured apples were transferred to steam sterilized trays, with the two injuries per apple exposed, and sprayed with a heavy suspension of spores of storage rot fungi. The trays of inoculated apples were placed in storage at $34^{\circ}F$. Blue mold rot readings were made on McIntosh in February and on Cortlands in March.

The Findings:

Captan 50 W, 2 lbs - alone and with No Scald* 2 lbs, or with Stop Scald* 1 pint, reduced blue mold rot a little, but not enough to talk about. Anti-scald properties were not adversely affected.

Difolatan* 4 Flowable 1 pint was tested without anti-scald materials. There was about as much blue mold rot as from water without fungicide.

Polyram* 80 W 2 lbs was tested without anti-scald materials. There was more blue mold rot than from water alone.

Benlate* 50 W 1 lb - Reduced blue mold rot on McIntosh to 3% compared to 29% from water dip without fungicide; and on Cortland to 0% compared to 53% from water dip alone. It did not interfere with scald control.

Benlate* 50 W 1 lb was the only one, of the 4 fungicides tested, that gave satisfactory blue mold control.

Benlate* is not yet registered for use in post harvest treatment of apples. It does have a temporary permit "For Experimental Use Only," as a post harvest treatment for fruit rot control and a 7 ppm residue tolerance which permits marketing of the fruit if the tolerance is not exceeded.

---

*Trade name

****

POMOLOGICAL PARAGRAPH

CA storage requirements of several apple cultivars: Not all apple cultivars (varieties) have the same atmospheric and temperature requirements for CA storage. However, it is not uncommon to find Cortland and Macoun apples in "hard" rooms (2% CO_2, 3% O_2 and 32^oF) while McIntosh rooms operating at 5% CO_2, 3% O_2 and 38^oF are available. In "hard" rooms these 2 cultivars occasionally develop excessive amounts of internal and external CO_2 injury. Internal CO_2 injury shows up as dry, brown areas or pockets in the flesh, particularly around the core. External injury appears as wrinkled, depressed yellow or brown areas on the green side of the fruit. It is safer to store Cortland and Macoun apples at 5% CO_2, 3% O_2 and 38^oF, than to store them in "hard" rooms.

For those who desire long-term storage of Spartan and Idared apples, we suggest placing them in "hard" rooms. Spartan apples store best in "hard" rooms and have pressure-tested 14-15 lbs in May. Idared apples are subject to a physiological disorder, known as Jonathan spot. This disorder can be commercially controlled by storing the apples in "hard" rooms.

Preliminary tests indicate that Empire stores well in "hard" rooms, but our observations with this cultivar are limited.

****

CONTROLLING FRUIT FLIES AT ROADSIDE STANDS

G.L. Jensen
Department of Entomology

Adult fruit flies (Drosophila or vinegar flies) are very small (less than 1/8 inch long), have bright red eyes and a tan-colored head and thorax, with a blackish abdomen. They are found everywhere in the world, and are very common wherever fruit and similar materials are permitted to rot and ferment. The entire life cycle of the flies can be completed in as little as 8 to 10 days, hence large populations can build up in only a few weeks.

To control these pests, one should eliminate as much as possible all rotting fruits, vegetables and liquids containing food particles from the premises. The flies can breed in almost anything that contains garbage, even such things as dish water from sinks, drain water from refrigerators and ice boxes, and floor scrubbings saturated with food particles. In short, practice good sanitation to help eliminate these and other insects.

In food establishments (and roadside markets), fruit flies can be controlled by frequent application of pyrethrum-synergist sprays, fogs or aerosals (the synergist is usually piperonyl butoxide). Frequent applications are necessary inasmuch as these sprays are of necessity very short-lived or non-persistent. Such sprays may be applied directly to the fruits in bags, boxes or bins, since pyrethrum has a low order of toxicity to warm blooded animals and produces no harmful residues on food crops when used according to the directions on the label.

Outdoors around packing or processing plants, unloading docks, outside walls and other areas where fruits are <u>not</u> present, may be treated shortly before the picking season begins and during shutdowns every 7 to 10 days with Diazinon* - 4 lbs. 50% WP per 25 gals of water.

*Trade name

****

CA STORAGE OF McINTOSH APPLES: PRE- AND POST-HARVEST FRUIT HANDLING AND STORAGE OPERATIONS

F.W. Southwick
Department of Plant and Soil Sciences

<u>Condition at Harvest</u>: Fruit to be placed in CA storage should be harvested in a somewhat immature and firm condition if it is to have the desired characteristics when offered for sale in late win-

ter and spring. Consequently, McIntosh for CA should have a flesh firmness of 15 to 17 pounds. This requirement applies irrespective of the use of Alar. Although Alar may provide excellent pre-harvest drop control and retard the rate of flesh softening for McIntosh until mid-October or later, the fruit is not generally firm enough beyond October 1, to be suitable for CA storage. Remember that when relatively soft, ripe fruit are placed in CA storage, fruit of poor quality is very apt to be present at the end of the storage period, no matter how well the CA storage room is operated.

<u>CA Storage Room Operation</u>: To reduce the tendency of fruit to scald and lose flesh firmness, apples should be transported from the orchard to a refrigerated storage room within a few hours. Ideally, the fruit should be cooled to 30-32^{o}F within 24 to 36 hours after harvest. Even though this ideal is not accomplished, the fruit should be stored in air until the temperature of the apples reaches 30-32^{o}F, regardless of the fact that 37-38^{o}F is the CA operational temperature. Generally, the keeping quality of McIntosh is improved by cooling the fruit to 30-32^{o}F in spite of the fact that sealing of the room may be delayed several days.

After sealing a CA McIntosh room(which is also suitable for Cortland, if the apples are properly treated for scald control), the temperature should be allowed to rise to 37-38^{o}F as the carbon dioxide (CO_2) level increases (to 3% for the first 4 weeks and 5% thereafter) and the oxygen (O_2) level declines to 3-4%. These atmospheres must be obtained within 20 days after the CA room is sealed to meet the legal requirements for CA rooms. In well constructed rooms these atmospheres are usually obtained within 10 to 15 days. Use of nitrogen generating systems, purging with cylinder nitrogen, reducing air velocity within the storage room and the use of "breather" bags all are ways of hastening the rate of oxygen decline and helping maintain it at the 3-4% level.

A very rapid oxygen drop may indicate that the CA room was sealed while the fruit was well above 32^{o}F and respiring at a relatively rapid rate. Of course, a rapid decline in oxygen level may signify a very gas-tight room as well. However, we have not been able to demonstrate that apples from CA rooms where the oxygen level was reduced from 20% to 3% in a few hours kept significantly better than similar apples held in an adjacent room where the oxygen level did not reach 3% until 2 weeks after the CA room was sealed. Also, the keeping quality of McIntosh apples is not improved by maintaining an oxygen level at 2.5% rather than at 3.0-3.5%. Therefore, there is no reason to maintain a 2.5% oxygen level and risk serious low-oxygen injury.

We do not encourage CA operators to attempt to improve the marketable life of apples by reducing the temperature of McIntosh CA rooms to 35-36^{o}F. There is some evidence that this reduction in temperature (compared to the recommended 37-38^{o}F) may improve the keeping quality of McIntosh slightly. On the other hand, there

have been some reports of occasional marked increases in flesh browning (considered to be CO_2 injury) in some CA rooms in New York State where a few CA operators have maintained temperatures at 35-36°F. Apparently, there are also a few people in Massachusetts who have been holding McIntosh in their CA rooms at 35-36°F. Although it is quite possible that fruit injury may not appear in most years or only on occasional lots of fruit in a given room, we do not believe the relatively minor improvement in fruit condition warrants the risk of serious fruit injury once every 5 to 10 years.

****

COLLAR ROT

Duane W. Greene
Department of Plant and Soil Sciences

At a recent meeting, the problem of collar rot or crown rot disease in apple orchards was discussed. The symptoms of this disease, caused by the fungus Phytophthora cactorum, are reduced tree growth, sparse light-colored foliage and a premature reddish coloration of leaves in the fall. Trees may show symptoms 2 or 3 years after planting, but generally they are more pronounced when trees start to bear.

Initial stages of collar rot are often difficult to detect. However, if infection is suspected, move all soil away from the trunk down to the large roots. Early stages of infection may be recognized by dark water-soaked areas in the bark. Advanced stages are characterized by large dark irregularly shaped areas on the trunk. Removal of some of the bark in these dark areas will reveal a tan or reddish brown inner bark. The disease will continue to spread until the tree is completely girdled.

Collar rot is most prevalent where trees are grown on heavy soils with poor drainage. On of the major avenues of entry into the tree is through injured tissue at the crown caused by ice damage. Infection generally occurs in the fall or spring when the fungal spores are most numerous.

Rootstocks differ in their resistance to this disease. Both MM 104 and MM 106 are especially susceptible. In addition, MM 104 grows very poorly under wet soil conditions and should not be planted in low, poorly drained areas. A low incidence of collar rot has been reported in trees on EM VII and EM II. McIntosh, Wealthy and Melba have proved to be resistant stocks.

Various measures may be taken to control this problem. Inarching above the infected area with seedling trees or clonal root-

stocks has been effective. More practical methods employ the use of chemicals. Soil is removed from around the tree and the infected area is cut away and left exposed to the air. Either maneb or ferbam, at a rate of 1 lb per 100 gals, can be sprayed on the infected areas. Maneb is preferred since it is active for a longer period of time in the soil. Application is made in the fall just prior to replacement of the soil around the tree.

Soil injections of maneb or ferbam around the crown may be effective in preventing infection by the fungus. It is suggested that 1/2 lb per 100 gals be applied once a year either in the spring as the buds open or in September. One quart on 2 sides of the tree should be sufficient for trees 2 to 4 years of age. The same quantity on 4 sides of a tree may be required for larger trees.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

DR. WM. J. LORD FN
PLANT & SOIL SCIENCES
FRENCH HALL

01002

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

Vol. 37 (No. 6)
NOVEMBER–DECEMBER 1972

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

FREEZING OF APPLES: HOW MUCH DAMAGE DOES IT CAUSE?

W.J. Bramlage and R.E. Bir
Department of Plant and Soil Sciences

In the fall of 1969, unusually early freezes occurred while many apples were still in the orchard. Many questions were raised about the effects of the freezing on apple quality and storage life, and there was very little firm evidence on which to base answers.

Most of the work that has been done on freezing of apples was done many years ago, using freezing procedures and conditions that are quite different from what happens in the orchard or during storage. At the January, 1970, meeting of the New York State Horticultural Society, Dr. R.M. Smock of Cornell University summed up (<u>Proc. N.Y. State Hort. Soc</u>. 115:199-204) what was known about freezing injury to apples and concluded that:

1. Less damage occurs to apples frozen on the tree than off the tree.

2. Apples should never be handled while frozen.

3. It is difficult to predict damage.

4. Frozen apples should be sold as soon as possible.

To learn more about freezing injury to apples, we conducted an extensive series of tests last year using 'Richared Delicious' apples. These apples were frozen under carefully controlled conditions, their temperatures were constantly measured, and the effects of freezing on condition of the fruit were determined immediately after freezing and after storage for 1-3 months at 32°F.

We found that the apples had two freezing points (Fig. 1). The first one was at about 28°F and the second one was at about 23-24°F, although in some fruits it occurred somewhat lower than this. We tested apples from August to mid-October and found that the temperature of these freezing points did not change as the fruits matured and ripened. This is the first time that more than one freezing point has been seen in apples, and what makes this finding important is that we learned that injury to the fruit is very closely related to these freezing points.

At the first freezing point, ice forms in the fruit and if held long enough at this temperature the apples will become "frozen solid." Any physical contact with the frozen apples will leave brown, sunken "contact points" after thawing, probably because the ice crystals pierce and kill the cells in the contact area. If the apples are allowed to thaw they will survive this freezing

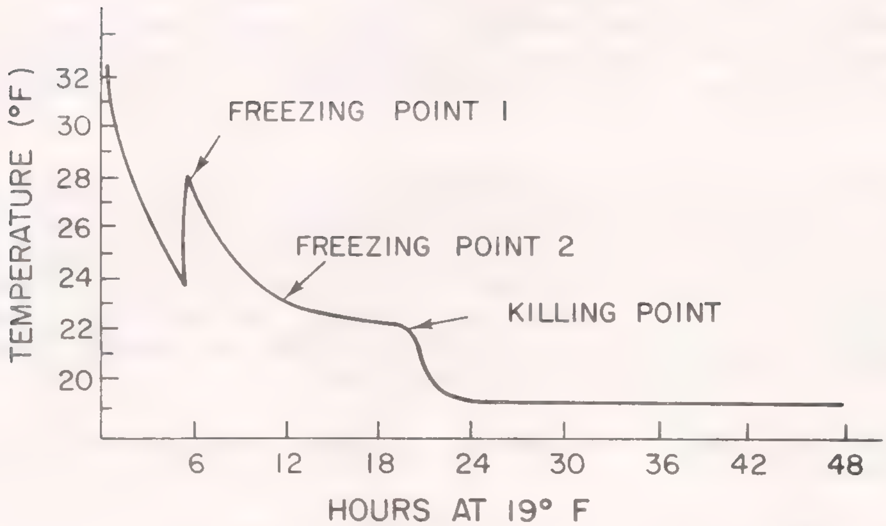


Figure 1. Typical freezing curve of a 'Richared Delicious' apple.

without visible damage other than "contact points." However, their condition is affected, in that they become softer after freezing to this first freezing point (Table 1). We measured 1-2 pounds difference in firmness between apples that had and had not been frozen to Freezing Point 1. We had some indication that the longer they remained frozen, the softer they became but the evidence for this was not conclusive.

Table 1. Firmness (lbs pressure) of apples after freezing at $25^{o}F$ for different lengths of time and then stored at $32^{o}F$ for up to three months.

Hrs at $25^{O}F$	Months at $32^{O}F$ 1	2	3
0	15.7	14.2	14.7
24	14.6	13.6	14.2
36	13.1	12.9	13.9
48	14.0	13.0	13.8
60	13.1	13.0	13.3
72	13.4	12.5	13.8

As the freezing temperature was lowered from Freezing Point 1 to Freezing Point 2, no additional injury occurred until Freezing Point 2 was reached. What causes the second freezing point to occur is not known, but apparently additional water suddenly becomes available for freezing. Ice formation gives off heat so that the temperature of the fruit remains about the same for a considerable length of time (Figure 1). As soon as Freezing Point 2 was reached, condition of the apples was affected in that they softened some more. Nevertheless, the apples did survive the freezing with no visual injury other than "contact points" when thawed.

The critical point during freezing of an apple was when the temperature dropped sharply from Freezing Point 2. Our data all indicated that at this point the apples were killed. The exact temperature at which this occurred varied with individual apples, but whenever this temperature drop occurred, massive damage (and apparently, death) occurred in the apple. The apples softened greatly and their respiration dropped sharply. Furthermore, upon softening the apples quickly began to discolor and to produce typical freezing injury symptoms. These are: variable amounts of surface bronzing and browning of the flesh, especially near the peel; browning of vascular strands in the flesh; and with severe injury, a dark brown ring near the peel underlain by water-soaked but only slightly discolored flesh. As time after thawing increased, either at room temperature or at 32^{o}F browning intensified, the fruit collapsed, and decay appeared.

When apples that had been frozen were stored for up to 3 months at 32^{o}, they looked the same as apples that had not been frozen unless they had been frozen to the "killing point." At the end of the storage period, those not killed were indistinguishable from the controls except that they were always softer. How much softer depended on whether they had been frozen to Freezing Point 1 or to Freezing Point 2. Those frozen to Freezing Point 2 were softer than those frozen only to Freezing Point 1.

We concluded from these tests that:

1. Any freezing probably softens apples.

2. Freezing to a fruit temperature of 26-28^{o}F will probably cause less softening than if the fruit temperature drops to 22-24^{o}F.

3. Unless the apples were frozen to the killing point, subsequent storage for relatively short times did not intensify freezing injury.

4. <u>Rates</u> of freezing and thawing within ranges that might occur in the field or in the storage had no effect on results. The important question was how cold the apples had become.

5. Storage did not mask the softening effects of freezing. In storage, the apples continued to soften so that differences remained distinguishable after storage.

Perhaps the most practically important finding in our studies was that extent of freezing injury could be measured quickly and easily. If apples have become frozen, samples should be thawed at room temperature and after a couple of days be compared with similar apples that were not frozen. If they have been killed, discoloration should begin upon thawing. If discoloration occurs, the apples have been ruined and cannot be salvaged. If they do not discolor, they have not been killed and the extent of damage can be measured by their firmness with a Magness-Taylor pressure tester. With this quick and simple assessment, the grower can make a decision on what to do with the apples after they thaw.

We did not determine the effects of freezing apples while they were still attached to the tree. However, Smock recently found that less visible injury occurred to apples frozen while attached than when frozen detached from the tree (HortScience 7: 174 (1972). It is likely that damage from freezing of attached fruits can be assessed the same way as suggested above for detached fruits. In considering freezing injury to fruits in the field or in the storage, a critical factor is to not handle the fruit while it is frozen. Physical contact with frozen apples, whether on or off the tree, will cause "contact points" to appear after thawing.

****

CALCIUM NUTRITION INFLUENCES APPLE QUALITY

Mack Drake, John H. Baker, and W.J. Bramlage
Department of Plant and Soil Sciences

Incidence of bitter pit in apples is known to increase as the calcium level in leaves and fruit declines. Although foliar sprays of calcium solutions have been shown to reduce bitter pit, they have not eliminated it. A major problem is the very poor absorption of applied calcium into apple trees and fruits.

We have been studying methods to increase the level of apple fruit calcium, using a block of over-30-year-old 'Baldwin' apple trees located at the Horticultural Research Center, Belchertown, Massachusetts. A series of treatments was begun in April, 1970, and include soil applications of lime and calcium nitrate, foliar applications of calcium nitrate, and combinations of foliar sprays with soil treatments. The specific treatments employed are listed in Table 1. A total of 52 trees are included in the experiment.

Table 1. The effects of various treatments on the foliar calcium content of 'Baldwin' apples.

Treatment number	Treatment description	Leaf calcium (%) change (1970-71 minus 1968-69)
1	Calcium nitrate, foliar (5 lbs/100 gals, 6 times annually)	+0.212
2	Soil liming (100 lbs/tree annually)	+0.094
3	Calcium nitrate, foliar, plus soil liming	+0.231
4	Soil calcium nitrate (7 lbs/tree annually)	+0.073
5	Soil calcium nitrate plus foliar calcium nitrate	+0.201
6	Calcium hydroxide plus magnesium hydroxide slurry, soil injection April, 1969	+0.103

In October, 1971, the second year of the experiment, one box of fruit was picked from each tree and scored for the occurrence of bitter pit. These fruit were then stored until late March at 32°F, when they were removed from storage and again scored for bitter pit occurrence. After an additional 5 days at 70°F, the presence of scald, internal breakdown, and decay was recorded.

Early in October, 1971, a separate set of fruit samples was taken from 11 trees known to be relatively low in calcium content, and from 8 trees known to be relatively high in calcium content. These apples were stored at 32°F until January, when they were removed from storage and their respiration rate during 9 days at 70°F was determined.

Although it is still too early in the experiment to fully evaluate treatment effects, certain trends are seen in this year's results.

In Table 1, the effects of the treatments to date on the leaf calcium content are shown. The greatest increases in calcium have resulted from foliar applications, either alone (Treatment 1) or in combination with soil applications (Treatments 3 and 5). Soil applications, whether employing lime (Treatment 2), calcium nitrate (Treatment 4), or an injected calcium hydroxide plus magnesium hydroxide slurry (Treatment 6), have been considerably less effective.

Although leaf samples were washed with distilled water before analysis, there is the possibility that traces of calcium spray residue contaminated the samples and accounted for at least part of the difference between the apparent effectiveness of foliar and soil applications.

Nevertheless, there was a highly significant correlation (r=+0.775) between leaf calcium content and peel calcium of the fruit. The importance of peel calcium content in relation to postharvest life of the fruit is clearly illustrated in Table 2. In this table, data are presented for only the two groups of trees sampled for fruit respiration. The samples in these two groups were from trees known to be relatively low or high in calcium content, regardless of treatment. It can be seen that there was about a 50% difference in either peel or leaf calcium between the two groups. This 50% difference was related to a dramatic difference in postharvest fruit behavior. Fifty percent more fruit calcium corresponded to a 17% lower respiration rate, 64% less bitter pit, 92% less internal breakdown, and 85% less decay. It had no relationship to the occurrence of scald. It is possible that the effects on internal breakdown and decay were indirect, arising from the initial relationship to bitter pit, but the overall effect of low calcium content was striking.

The data in Table 2 illustrate the importance of maintaining an adequate calcium content in these apples. The problem then returns to the difficulty of increasing calcium content of apple trees and fruit. However, the data in Table 1 indicate that we are making progress on this problem. How far will these treatments go in developing adequate calcium levels in the fruit, or how long will it take to reach adequate levels? These are questions to be answered in coming years, as this experiment progresses.

Table 2. Relationship of calcium content of 'Baldwin' apples to their postharvest life. 1971-1972.

Peel Ca content	Respiration rate	Bitter pit	Scald	Internal breakdown	Decay
%	($MgCO_2$/kg-hr)	(%)	(%)	(%)	(%)
0.048[1]	45.6	82	57	12	34
0.074[2]	37.5	30	53	1	5

[1]Leaf calcium averaged 0.67%.

[2]Leaf calcium averaged 1.09%.

This experiment employs only the cultivar 'Baldwin' but we suggest that relationships similar to those seen here exist for other apple cultivars as well.

PINE MICE - WHAT'S NEW?

Edward R. Ladd
U.S. Fish and Wildlife Service

For more than 30 years, the Pine Mouse has been the subject of great interest to orchardists in the Eastern United States. Their major concern has been the damage caused to root systems by this animal in its search for food. The root damage is such that, except in extreme cases, the tree is not killed in one season. Instead, its decline may take several years and be seen as lost vigor and production--as well as reduction of revenue to the grower.

Recently, a symposium on Pine Mice was held in the State of New York to bring together the views and accomplishments of persons interested in the problem. The result was a more clear understanding of wherein the problem lies, what research is under way, and in what areas research and support efforts still need coverage.

Much of the program was devoted to delineating the overall problem areas (see map) and the variation or intensity of the problem within that area. Perhaps the material is best summarized by stating that the intensity of the pine mouse problem can and does vary by orchard--and even by blocks within an orchard. Some areas may have pine mouse problems to the extent that tree loss or damage is heavy; yet, neighboring blocks of trees, or orchards, will have a minimal problem--or none at all.

Of major interest to all attending the program were the research programs being conducted on the pine mouse. A short resume follows.

1. CHLOROPHACINONE AND HERBAGE AS POTENTIALS FOR PINE MOUSE DAMAGE CONTROL.--Frank Horsfall, Jr., Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

Dr. Horsfall, for the past several years, has been working on a concept of integrated control. His work has developed a list of grass and forb (broadleaf plants) species that create a balanced habitat in the orchard. Such a balance of species contains numerous plants actively sought as food by pine mice; the theory is that with a surplus of desirable foods available, pine mouse damage to tree root systems would be minimal.

Dr. Horsfall has extended his work on the balanced food concept into the field testing of an experimental anticoagulant, Chlorophacinone. Using the selected plant species as ground cover under trees, the experimental Chlorophacinone has been applied as a ground spray and the resulting controls measured.

PRESENT RANGE OF THE PINE VOLE *Pitymys pinetorum* IN NORTH AMERICA

2. DYNAMICS OF THE PINE VOLE IN A COMMERCIAL ORCHARD.--Lynn E. Walsh, Massachusetts Cooperative Wildlife Research Unit, University of Massachusetts, Amherst, Massachusetts.

Miss Walsh's study is to cover the density, distribution, and movement of pine mice in a commercial orchard. Data are to be identified in the orchard by habitat variations, such as vegetation, soil type, thickness and kind of humus, and general topography.

This study, when completed, hopefully will give a better understanding of habitat selection by pine mice. That is, why are they in one specific location and not in another that appears identical? The study also will provide data on movements to and from the orchard, as well as from tree to tree, and perhaps some idea as to vertical movement in the soil.

3. AGGRESSIVE BEHAVIOR OF THE PINE MOUSE.--George L. Kimball, III, State University of New York, New Paltz, New York.

Mr. Kimball has been conducting laboratory studies on the rank (peck order), behavior of dominant and sub-ordinate individuals, fighting, threat, and appeasement attitudes of individual pine mice. This project covers the involvement of individuals within a given population unit and the strife or involvement between adjacent units. Mr. Kimball's theory is that behavioral action between individual mice and population units may have a definite role in determining the size of a pine mouse population.

4. VOLE POPULATIONS IN NEW YORK ORCHARDS.--R.S. Gourley and M.E. Richmond, New York Cooperative Wildlife Research Unit, Cornell University, Ithaca, New York.

Much of Mr. Gourley's efforts are toward the building of reproductive and life history tables for the pine mouse. Such items as life span, age, sex structure, mortality, birth pattern, total offspring per female, life span, survival rate, and rate of population increase are being measured. Much of this information is being gathered from the laboratory pine mouse colony maintained at Cornell. It is supplemented by frequent measurements in a commercial orchard to test validity and usability under field situations. These field studies are also providing material on population census and pine mouse activity signs.

The ultimate goal of all these projects, and others to be started, is to gain a more complete and better understanding of this pest species--the PINE MOUSE. It is only through the complete understanding of any pest species that logical, intelligent, and acceptable methods of control can be achieved.

****

FRUIT NOTES INDEX FOR 1972

(This index of major articles has been prepared for those who keep a file of Fruit Notes. The number in parentheses indicate the pages on which the item appears.)

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S.MAIL

FRUIT NOTES

Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

Vol. 38 (No. 1)
JANUARY–FEBRUARY 1973

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

RECENT TREE FRUIT VARIETY INTRODUCTIONS

J.F. Anderson
Department of Plant and Soil Sciences

This is an up-date of previous reports on fruit varieties and selections under test at the Horticultural Research Center in Belchertown. As most of our observations have been limited to 4 or 5 years, we must consider them to be preliminary in nature. We are also including descriptions of several varieties that have not been tested at our Belchertown facility, this is being done as an aid to growers wishing to select varieties for new plantings.

APPLES

Quinte

An Ottawa introduction ripening in late July and early August. The fruits are medium in size (2-1/2"+), round-conic in shape and averaged greater than 80% red color in 1972. Fruit quality is good. The attractive red blush, shape and smooth finish are strong points of this new variety.

New Jersey #36

This selection ripens in late July and early August at the Horticultural Research Center. The fruits are of medium size, angular, roundish-oblate in shape and have a bright smooth finish and medium red color. The eating and keeping qualities of the early-ripening selection are very good. New Jersey #36 has been at least equal to Julyred in our trials.

Julyred

A New Jersey introduction ripening during the first week of August. The fruits are of medium size, medium red color and have a bright smooth finish. The eating, handling and keeping qualities are very good. Julyred appears to be promising.

Caravel

We fruited this Ottawa introduction for the first time in 1972. The fruit was less than medium in size and had much less color than Quinte. The apples are roundish-oblate in shape and have good dessert quality. Caravel is said to be a biennial producer.

Jerseymac (New Jersey #38)

This recent 1971 introduction <u>has not</u> been tested at the Horticultural Reserach Center, but it is considered to be a very promising variety by many fruit specialists. Jerseymac ripens about one month before McIntosh, is above medium in size, has a pale yellow undercolor and good overcolor (80% red). The fruit flavor is aromatic and the eating quality is good. The texture is medium-firm but the fruit bruises easily. The trees are said to be productive and annual.

Tydeman Early (Tydeman Red)

This English variety ripens in late August and is similar to McIntosh in appearance and slightly larger in size. The fruits have a green undercolor and are overlaid with a medium-red blush. The fruit has good quality and looks promising for the early fall trade. The tree is similar to Rome in its growth habit.

Paulared

This recent introduction ripens with or slightly after Tydeman. The fruits of Paulared are medium to large in size, roundish-oblate in shape and have excellent finish. The fruit colors early and has a solid red blush at harvest (Aug. 31, 1972) Our limited trials suggest that Paulared is most promising for the early September market.

Summerred

We have fruited this British Columbia introduction for two seasons. Summerred ripens in late August. The fruits are round-conic to oblong in shape, above medium in size and have a bright red blush. The dots have been conspicuous and often russeted in our trials. The fruit quality has been good. Summerred is a McIntosh X Delicious cross.

Niagara

This variety ripens about 10 days before McIntosh. Niagara is similar to McIntosh in shape and color. The fruit finish has been less than satisfactory in past seasons. The fruit seems susceptible to russeting and the lenticels have tended to be larger and blurred. The eating quality of Niagara is very good and the variety has been well received by those who have tried it here at the University.

Jonamac (New York 44[illegible])

A New York Agricultural Experiment Station introduction originating from a McIntosh X Jonathan cross. This McIntosh type apple is said to be superior to McIntosh in both color development and eating quality. Jonamac is an early fall apple that ripens about 8 days earlier than McIntosh and is being recommended to replace some of the McIntosh now harvested when immature and marketed before they are ripe. The foregoing comments are based on the originator's description.

Empire

A very promising introduction of the New York Agricultural Experiment Station at Geneva. Empire, resulting from a McIntosh X Delicious cross, was introduced in 1966. The fruit ripens about 2 weeks later than McIntosh. This very attractive apple has a solid red blush, is of medium size, has very good dessert quality and has been a good keeper. The tree appears to be annual and productive. This appears to be a very promising variety.

PEACHES

Collins

A New Jersey introduction ripening a few days before Sunrise. The peach is medium-sized, firm and yellow-fleshed. Collins is semi-cling when picked at maximum shipping condition and a freestone when fully matured. Thinning is recommended to insure good size.

Brighton (N.Y. 2622)

A 1972 introduction of the New York Agricultural Experiment Station. Brighton is described as an attractive, high quality yellow-fleshed peach, ripening just before Sunhaven. The fruit is roundish, uniformly medium in size, and nearly all-over bright red on yellow ground. The flesh is medium firm,

semi-cling, slightly fibrous, juicy and slow to oxidize, with a sweet, rich flavor. It attains its high quality while still quite firm and maintains it well. The tree is vigorous, productive and medium-hardy. (Introducer's description)

Sunrise

An attractive, yellow-fleshed peach of medium size. It is firm and almost a freestone when ripe. Has been a biennial bearer in our orchard.

Golden Dawn

A seedling peach that was discovered in the Bolton orchard of Jonathan Davis in 1953. It is a yellow-fleshed peach of high quality which ripens with Jerseyland.

Reliance

An introduction from the New Hampshire Agricultural Experiment Station is said to be extremely bud-hardy. It is reported to have survived minimum temperatures of -25°F. The fruit is nearly round, moderately fuzzy and has a dull red color. The bright yellow flesh is juicy, medium firm, slightly stringy, of good flavor and ripens with Redhaven.

Goldgem

A large yellow-fleshed peach that ripens at the same time as Golden Jubilee. It does not have the solid red of Redhaven, but it is easier to grow and tends to run larger in size.

Eden (N.Y. 1466)

This New York Agricultural Experiment Station selection was introduced in 1972. It is being described by the introducing agency as a very productive white-fleshed peach that ripens about 3 days before Halehaven or in between Raritan Rose and Redrose. The fruit is large, roundish and 60% red on creamy-white ground. The flesh is thick, firm, juicy, freestone and nearly smooth textured, with a sweet rich flavor, and oxidizes slowly for a white-fleshed peach. It has canned well. The tree is vigorous, very productive and equal to Richhaven in bud-hardiness.

Washington

One of a new series of introductions from the Virginia Polytechnic Institute (V.P.I.). Its flowers are reported to be extremely tolerant of spring frosts. The fruits are round, ovate in shape and a high percentage of the skin is covered with a bright red. The flesh is orange-yellow with a bright red at the pit. The flesh is fine textured and it resembles Sunhigh in flavor. This variety ripens about 3 weeks before Elberta. Washington lacks sufficient winter bud-hardiness under our conditions.

Summerqueen

A large, attractive, firm, yellow-fleshed peach of excellent quality. This New Jersey introduction ripens with Sunhigh. Summerqueen requires cross-pollination.

Redqueen

Was selected by the New Jersey Agricultural Experiment Station because of its bud-hardiness. The fruit is large, well-colored and of good quality. It is equal to Elberta in shelf life and firmness. Redqueen ripens about 14 days before Elberta. This variety has been productive in our orchard.

Madison

A highly colored, attractive peach with short pubescence. The flesh is yellow, firm, juicy and has a good flavor. Sets very heavy crops and requires heavy thinning to maintain medium size.

Cresthaven

A large, oblate-shaped peach with a dark red blush. The bright yellow flesh is firm, juicy and slightly fibrous. There is some red at the pit. The flavor is very good. The tree is vigorous, productive and medium in hardiness. Recommended for trial on basis of performance in other areas.

Jefferson

Another V.P.I. introduction with blossoms that are resistant to spring frosts. The fruits are large and well-colored. The flesh is yellow and comparable to J.H. Hale in flavor and and firmness. Jefferson ripens 2 to 3 days after Elberta. Jefferson lacks winter bud-hardiness.

PLUMS

Howard Miracle (Japanese)

A large, attractive, high quality Japanese plum. The fruit is golden yellow with a light red blush. The firm-fleshed, freestone is picked in late August. Production was very good this year. The flavor of this variety is not typical of a plum and might be objectionable to some.

Ozark Premier (Japanese)

A large, attractive plum with a medium-red overcolor and firm yellow flesh. The quality of the fruit is very good. The tree is vigorous and appears to be productive. The fruit is ready in late August.

Mohawk (European)

This variety, along with Oneida and Iroquois, was named by the New York Agricultural Experiment Station in 1966. Mohawk is an attractive blue prune, ripening in late August. The size is medium to large and the quality is very good. Production has been moderate. Mohawk is said to be self-unfruitful.

Seneca (N.Y. 981) (European)

This variety was named in 1972. It is a large, attractive, oval, reddish-purple plum of a very high quality. Seneca was a good producer in our Amherst orchard. Seneca ripens in late August and early September.

Iroquois (European)

An attractive blue prune that ripens in early September about a week before Stanley. The fruit is of medium size, longer than Stanley and of good quality. The tree is productive. There was some splitting of the fruit when the trees first came into bearing in our Amherst orchard. Iroquois is said to be self-fruitful.

Oneida (European)

A large, reddish-black prune shaped plum of very good quality. The tree is medium in size, vigorous and productive. Oneida keeps well in storage and appears to be worthy of trial where a late ripening plum is desired.

NECTARINES

We have fruited the following nectarines the past 5 seasons. They appear to be quite reliable in production.

Lexington

This has been a productive variety in our planting. The fruits are about 2-1/4" in diameter, have an attractive red overcolor and yellow undercolor. The flesh is yellow, has a good flavor and a freestone. Lexington ripens in the last week of August.

Nectarose

This variety ripens in early September. The surface color is bright red and the undercolor whitish. The fruits average larger in size than the other 3 varieties under test. The flesh is white, the stone free, and the flavor good.

Nectaheart

This white-fleshed variety ripens in the first week of September. The flesh is white and the stone free, the quality is good. The surface color is a bright red. Nectaheart fruits have averaged slightly under 2 inches in diameter.

Cavalier

A yellow-fleshed freestone variety ripening in the first week of September. The fruits have averaged slightly under 2 inches in diameter, and have an attractive red surface color.

****

POMOLOGICAL PARAGRAPH

Aspiration bulbs continue to be troublesome: Many growers use a rubber aspiration bulb to pump samples of atmosphere from their CA rooms to the Orsat analyzer. These bulbs become porous and practically every year some CA storage operator obtains erroneous readings with his Orsat analyzer because of introduction of outside air through the bulb during the aspiration process. Two years ago, 'McIntosh' apples in 2 CA rooms were severely injured from low oxygen (O_2) because the leaky aspirator bulb was responsible for higher O_2 readings than were actually present in the atmosphere of the storages.

A few storage operators who have short sampling lines to the storages skip the rubber aspiration bulb and use the water levelling bottle to take their CA storage atmosphere samples. For most storage operators, however, it is more practical to replace the aspiration bulb with a small air pump. The investment in an air pump is minute in comparison to the value of the apples in storage.

****

SAN JOSE SCALE — LIFE HISTORY AND CONTROL

G.L. Jensen
Department of Entomology

San Jose scales *(Quadraspidiotus perniciosus)* have been the object of numerous complaints during the past season. They are small (about 1/12 inch across) disk-shaped insects which are just discernible to the naked eye. Under the hand lens the disks reveal a raised nipple-shaped spot near the center.

All parts of the tree are attacked above ground level including the trunk, branches, leaves and fruit. Usually, the bark or skin of the fruit is reddened for a short distance around each of the scales. This phenomenon is especially noticeable on young trees and on new growth of old trees. Heavily infested trees show a general decrease in vigor and the foliage is sparse. If infestations are allowed to develop unchecked, trees may be killed. Terminal twigs chacteristically die first. The fruits of infested trees often are mottled or spotted in appearance due to the reddish inflamed areas surrounding each of the scales.

Life Cycle

The insect passes the winter in a dormant, partly grown condition under small black scales. Under New England conditions, all other stages of the insect are killed during the winter months. The small scales break dormancy at about the time the sap begins to flow in the spring. They usually become full-grown by full bloom. The winged males emerge in May. The females which never become winged nor emerge from beneath the scale give birth to living young which have the appearnace of yellow mites or lice. These are known as "crawlers", and they crawl over the surface of the bark for a short time seeking the proper spot to settle down. Upon settling down, they insert their slender thread-like mouth parts through the bark and being sucking the sap. They soon molt and along with their old skin they lose their legs and antennae, becoming only flattened yellow sacks attached to the trees only by their mouthparts. As they grow, they secrete a waxy substance which forms the protective scales under which they live. There are probably 3 generations of scale each year in this area. As with most insect pests, they are favored by hot, dry weather.

The insects are carried from orchard to orchard on the bodies of birds and larger insects, but probably to a greater extent by wind or air currents. In common with many scale insects, they also often spread on contaminated nursery stock.

Control Measures

These insects are best controlled with 60 or 70 Second oil at 2 gals/100 during the half-inch green stage. In order to realize satisfactory control, it is necessary to obtain a thorough coverage

of the entire tree since the tiny scales are generally distributed over the entire tree and only those hit with the spray will be killed.

During the growing season (petal fall and first cover) Guthion* (1 lb 50 WP), carbaryl (2 lbs 50 WP or 2/3 lb 80S) and Diazinon* (1/2 lb 50 WP) are all effective against the crawler stages.

*Trade name

****

POMOLOGICAL PARAGRAPH

Publication availiable: In January, 1969, a National Controlled Atmosphere Research Conference was held at Michigan State University. This conference was summarized in an article entitled "What's New with CA Storage"in the March-April, 1969 issue of *Fruit Notes.*

The entire Proceedings of this conference was published as Horticultural Report No. 9 by the Horticulture Department at Michigan State. The available supply was quickly exhausted and in response to a continuing demand, the Proceedings have been republished. A copy may be obtained by sending an order to the Department of Horticulture, Michigan State University, East Lansing, Michigan 48823. The cost is $2.50 for domestic orders, $3.00 for foreign orders, and an order should be accompanied by a check or money order written to the order of Michigan State University.

A great deal of information is contained in this publication, and the information is only slightly outdated. This publication should be of interest and value to anyone concerned with the broad application of CA storage.

****

RECENT SMALL FRUIT INTRODUCTIONS

James F. Anderson
Department of Plant and Soil Sciences

Three blueberry varieties, Bluetta, Lateblue and Elizabeth were introduced in 1967. None of these have been tested in our University plantings and the following notes are taken from the introducer's descriptions.

Bluetta

A new blueberry variety released by the Crops Research Division of the U.S.D.A. and the New Jersey Agricultural Experiment Station.

The plants of Bluetta are short compact spreading and

medium in vigor. The fruit is medium-sized, light blue in color, firm but has broad stem scars. The fruit is said to have more flavor than Weymouth and to be more resistant to spring frosts than Weymouth and to be more resistant to spring frosts than Weymouth. Its outstanding features are early ripening and consistent production. The above notes are based on performance of the variety in New Jersey.

Elizabeth

Was developed by the late Miss Elizabeth White and was introduced by the New Jersey Cultivated Blueberry Council, Inc. It has an unusually long picking season. The berry color is a medium blue and its size very large being about equal to Herbert. Its dessert quality and flavor are rated as excellent. It is very sweet and aromatic. The clusters are very loose and easily picked. The scar is small. Elizabeth is similar to Coville in vigor and growth habit. The plant is said to be a good producer and to be hardy. Elizabeth appears to thrive best on moderately peaty soils and is not recommended on very sandy soils.

Lateblue

Was introduced by the U.S.D.A. and the New Jersey Agricultural Experiment Station. The plants are erect, vigorous and consistently productive. The fruit is borne in medium-sized clusters. The berries are highly flavored, firm, light blue in color and have small stem scars. They are smaller and ripen about one week after Coville. One of its outstanding features is simultaneous ripening of fruit in a short period of time.

STRAWBERRY

Holiday (N.Y. 1144)

Is a new very firm-fruited variety for commercial planting or home gardens. The plants are productive, vigorous, making a good matted row of well-spaced plants. The fruit is large, very firm, bright red, glossy, attractive, oblate to round-oblate. Primary fruits hold in good condition until secondaries and even some tertiaries ripen, thus exhibiting concentrated ripening. The fruits are of good quality with a distinctive aromatic flavor. Holiday is a good freezer and ripens in early-midseason. (Originator's description)

****

RESEARCH FROM OTHER AREAS

William J. Lord
Department of Plant and Soil Sciences

The Influence of Shade and Within-Tree Position on Apple Fruit Size, Color and Storage Quality: Several experiments to determine the influence of shade and within-tree position on fruit size,

color and storage quality of 'Cox's Orange Pippin' apples were conducted by J.E. Jackson, R.O. Sharples and J.W. Palmer, East Malling Research Center, Kent, England and reported in Vol. 46 (No. 3) of the *Journal of Horticultural Science*.

The studies showed that apples from the inside of the trees differed from those borne on the outside and similar differences were obtained by artificially shading parts or the entire tree. Fruits harvested from the tree periphery were larger and better colored but were more susceptible to bitter pit and rot due to *Gloeosporium* spp. and to soft rot fungi. However, these fruit were less susceptible to shrivel and core flush than fruits from the more shaded parts of the tree.

The effects of in-tree position on their storage behavior in relation to fruit size and mineral composition also were studied. Fruits from 2 trees growing in an east-west hedgerow that were well exposed to the south were separated according to whether they were harvested on the north side (segment) or south side (segment) of the trees or whether they were picked with (upper segment) or without a ladder (lower segment). Size of the fruit reached from the ground was larger from the south side than the north side of the trees. Fruit size did not differ between the north and south upper segments of the trees, however. Fruit from the upper segments and larger fruit from within each segment of the tree had more red color.

After storage, a relationship between size and bitter pit only was evident on fruits from the upper segments of the trees; the incidence of pit was greater on the larger fruits. Although not severe, *Gloeosporium* rot was more frequent on larger fruits and more severe in the upper segments of the trees.

Severity of shrivelling differed little among the tree segments but the disorder was more severe on smaller than on larger fruits.

Concentration of nitrogen was higher in smaller fruit than larger fruit from a similar segment of the tree. Calcium contents and the ratios of calcium (Ca): potassium (K) were lower in the larger fruits within each tree segment and in fruits from the upper segments of the trees.

In storage, the fruits from the upper segments of the trees developed more bitter pit than similar-size fruits from the lower segments. Within the upper segments of the trees, larger fruits developed more bitter pit than the smaller fruits.

Editors' Note: The advantages attributed to small apple trees from the standpoint of better fruit color and fruit size probably are due to greater exposure of foliage and fruit to light. These studies by Jackson et al. which indicate that larger and better-

colored fruits were more susceptible to bitter pit emphasize the need for Ca in our plantings on size-controlling rootstocks since both bitter pit and cork spot development appears to be most directly related to low calcium in the peel area of apples.

The findings of Jackson et al. also support our observations in 1971 that cork spot was more severe in the tops of 'Delicious' apple tree than on the lower limbs.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business
Penalty for Private Use, $300

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

FRUIT NOTES

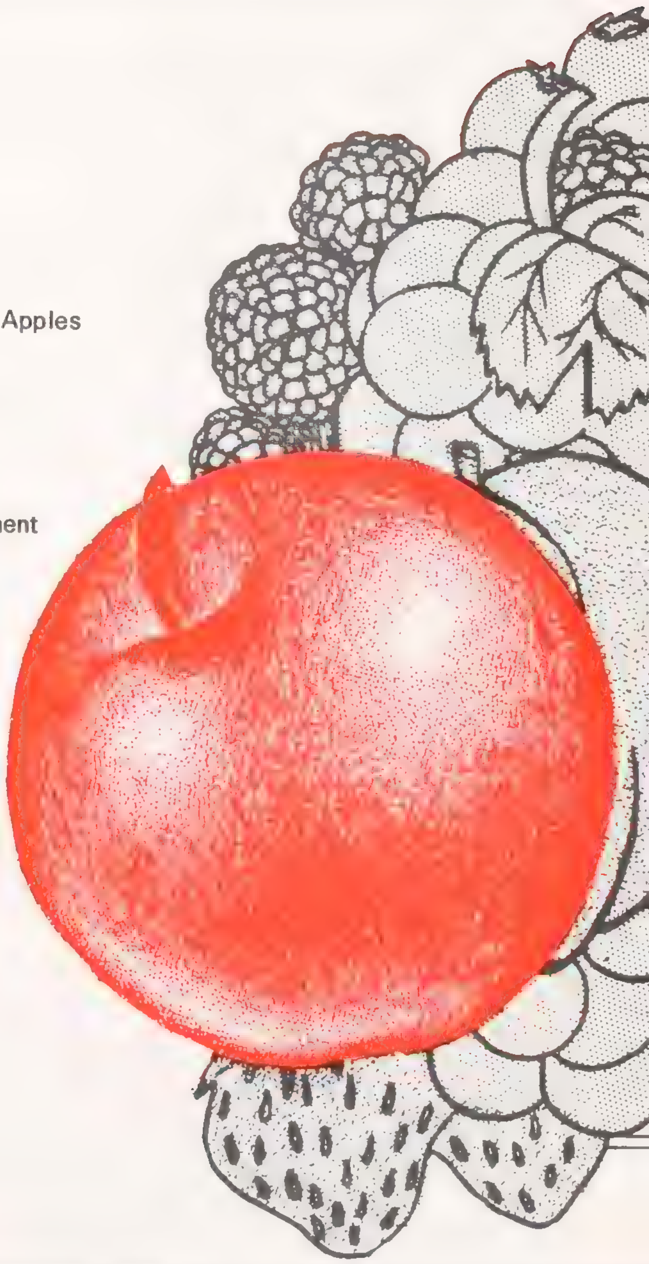
Prepared by the Department of Plant and Soil Sciences
Cooperative Extension Service
College of Agriculture
University of Massachusetts, Amherst

EDITORS

W. J. LORD AND W. J. BRAMLAGE

Vol. 38 (No. 2)
MARCH–APRIL

TABLE OF CONTENTS



Issued by the Cooperative Extension Service, A. A. Spielman, Dean and Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

SUGGESTIONS FOR FERTILIZATION OF APPLE TREES IN 1973

William J. Lord
Department of Plant and Soil Sciences

More growers participated in our leaf analysis program in 1972 than in any previous year. Thereby, we obtained considerable information concerning the nutritional status of our apple trees which is discussed below in conjunction with fertilization suggestions for 1973.

Although leaf analysis is a valuable tool for determining nutritional status of fruit trees, it is no substitute for careful observations of tree growth, fruit size, and fruit color when deciding the amount of nitrogen to apply. In the case of the other essential elements, however, leaf analysis is the best means of determining if their levels in trees are low or excessive.

The essential elements for apple trees are supplied either by foliar or soil applications. However, we think it is safest to apply all elements as a fertilizer except in emergency cases because foliar sprays may be more expensive, be of no benefit, or could damage fruit.

Nitrogen (N): N is still the key to a satisfactory fertility program. The desirable N content of leaves from bearing 'McIntosh' apple trees is 1.80-2.10%. In 1972, 56% of the leaf samples from bearing trees of this cultivar exceeded 2.10%. The remaining samples, with one exception, were within the desirable range. A limited number of leaf samples from young 'McIntosh' trees (10 years of age or less) averaged 2.24% N and some samples from bearing 'Delicious' trees averaged 2.25%.

Since apple trees are showing abundant flower buds, thus indicating a potentially good crop for 1973, we are suggesting that in 1973, growers should:

1. Apply no more than normal rates of N.
2. Omit or reduce N applications by one-half in those blocks of 'McIntosh' trees which produced fruit with poor color in 1972.
3. Reduce or omit N on young, vigorous 'McIntosh' trees if they are starting to bear a crop in order to avoid excessively large, poorly colored fruit. Young, vigorous, nonbearing 'McIntosh' apple trees may have N levels of 2.4-2.6%, but these high N levels should be reduced when trees start to produce.
4. Apply sufficient N to keep bearing 'Delicious' trees vigorous. N levels of 2.2-2.4% in bearing 'Delicious' trees are probably satisfactory because it is necessary to keep the tree vigorous in order to produce large-sized fruits.

4. (cont) Furthermore, obtaining sufficient red color on the newer strains of 'Delicious' is not a problem.

Suggested rates of actual N for bearing apple orchards, based on potential yield of trees are as follows: (a) less than 15 bushels (bu): 0.66 lbs.; (b) 15 to 25 bu: 0.66 to 1.00 lbs; (c) more than 25 bu: 1.33 to 2.00 lbs. These suggested amounts are for hand applications under the spread of the branches. When the materials are broadcast over the entire orchard floor, it may be necessary to increase the rate of application in order to obtain the same tree response as with hand applications.

Calcium (Ca): Ca in 'McIntosh' and 'Delicious' leaves in 1972 averaged 0.80% and 0.71%, respectively, which is considerably less than the desirable content of 1.25-1.50%.

The incidence of cork spot and bitter pit in apples is known to increase as the calcium level in leaves and fruit declines. Furthermore, recent data show that fruits with low Ca content develop more internal breakdown and decay in storage than those with a high Ca level.

It is very difficult to increase Ca content of apple trees and fruits. Although foliar sprays of Ca solutions have been shown to reduce bitter pit, they have not eliminated it. A major problem is the very poor absorption of applied Ca into apple trees and fruits. Furthermore, Ca in the soil moves very slowly in the tree and most of it is quickly tied up in insoluble form. However, we suggest the following measures to increase Ca content of apple leaves and fruits. How far these treatments will go in developing adequate Ca levels, or how long it will take to reach adequate levels, is not known.

1. Continue to apply 3 tons of limestone per acre every 2 to 3 years. Where high magnesium lime was used in the last application, the use of a more soluble high Ca lime will act more rapidly and will provide more Ca.

2. Change from ammonium nitrate or urea sources of fertilizer N to calcium nitrate. Calcium nitrate fertilizer quickly increases the level of soluble soil Ca, increases the downward movement of Ca and raises the pH of the soil.

3. Apply 3 to 5 calcium sprays at 10-day intervals, starting 2 weeks after petal-fall. We suggest using calcium nitrate (fertilizer or technical grade) at the rate of 5 lbs per 100 gallons of water. A spreader or wetting agent, such as Triton B, should be used at the rate of 3 fluid ounces per 100 gallons of water.

4. Calcium nitrate may stimulate shoot growth which will compete with the transport of Ca into the fruit. Calcium

4. (cont) chloride, at 2 pounds per 100 gallons, will not stimulate growth, and may be a preferable source of Ca in the early sprays. We would like to have a few growers conduct limited trials with calcium chloride to obtain more information on its effectiveness and its safety of use from the standpoint of leaf injury.

Potassium (K): The desirable level of K in bearing apple trees expressed as percentage dry weight is 1.25-1.60. In 1972, 35% of the 'McIntosh' leaves were below these levels whereas only 13% of those from 'Delicious' trees were found to be low in K. Since this element generally is not higher than the desirable level in apple leaves, K may be needed annually.

The requirements for K (expressed as K_2O) based on potential yields are as follows: (a) less than 15 bu: 1.3 lbs/tree; (b) 15 to 25 bu: 1.3-2.7 lbs/tree; (c) more than 25 bu: 2.7-4.3 lbs/tree. The K_2O requirements can be supplied by applying muriate of potash, a "complete" fertilizer, or either Sul-Po Mag* or K-Mag*. The latter two fertilizers may be of value when both K and magnesium (Mg) are low, since they are sources of both of these elements. High levels of K can depress both Mg and Ca, particularly if the soil supply of Mg and Ca is low.

Magnesium (Mg): Low magnesium levels (less than 0.25%) were present in 20% of the leaves sampled in 1972. The Mg requirements of trees can best be met by maintaining an adequate dolomitic liming program. Since it takes several years before lime is effective in correcting Mg deficiency, Epsom salt sprays can be used to help correct the condition. Apply 2 or 3 sprays at the rate of 15-20 lbs per 100 gallons of water at the time of calyx, first cover and second cover sprays. To avoid possible incompatibilities, the Epsom salt sprays should not be combined with the regular pesticide sprays.

Boron (B): B was generally low in the leaf samples obtained in 1972. B can be supplied to apple trees either by foliar or soil applications. Use the most economical and convenient method.

Soil applications of B should be applied to orchards every 3 years. Borax is the common material used. The rates of application per tree vary with age and size. Apply 0.25 lb of fertilizer borate (20.2% B) or its equivalent to young trees, 0.5-0.75 lb to medium age and size trees, and 0.75-1.00 lb to large or mature trees. If the soil application of B is followed by a wet spring and summer, it may be advisable to apply 2 foliar applications of B the following year.

Many growers rely on annual foliar applications of B. The usual practice is to add Solubor* to the first 2 cover sprays. Fertilizer grades of borax may contain grit and should not be used in a sprayer. Mature trees should receive 4 lbs of Solubor* per

*Trade Name

acre each year. Consequently, the goal is to apply about 2 lbs per acre in each of the 2 applications. For young orchards, the addition of 0.5 lb of Solubor* per 100 gallons (dilute basis) to the first 2 cover sprays meets the B requirement of these trees. Reports from New York State indicate that sprays can be concentrated up to 8X with satisfactory results.

Manganese (Mn): This element was low in 48% of the orchards sampled in 1972. In some orchards, deficiency symptoms were evident. (A picture and description of deficiency symptoms of this element appeared in the May-June, 1972, issue of *Fruit Notes)*.

Research has shown that in its milder stages, Mn deficiency of apple trees does not seem to be accompanied by loss of tree vigor or fruitfulness. However, the condition can be corrected by foliar applications of manganese sulfate or of a fungicide containing Mn. Manganese sulfate is applied about first cover at a rate of 3 lbs per 100 gallons of water. If using an Mn-containing fungicide, 2 or 3 applications are necessary with timings about petal fall, first and second cover.

Zinc (Zn): Based on optimum levels of Zn established by some states, some of our apple orchards are low in this element. We are not convinced that dormant applications of zinc sulfate are worthwhile from the standpoint of increasing tree performance. Until the value of this zinc sulfate spray applied at the "green-tip" stage of bud development can be substantiated, we suggest its use only on a trial basis.

****

INFLUENCE OF POTASSIUM ON CALCIUM UPTAKE OF 'DELICIOUS' APPLES

William J. Lord
Department of Plant and Soil Sciences

Since several apple fruit disorders are associated with inadequate calcium (Ca) in the fruits, growers have been cautioned against excessive use of potassium (K) because this element suppresses Ca uptake. To help maintain a balance between Ca and K, it has been suggested therefore, that leaf K levels be maintained in the range of 1.25 to 1.50%. However, studies by the late Dr. Walter Weeks with a 'Delicious' cultivar indicated that decreased accumulation of Ca in the foliage occurred only at K levels far in excess of 1.50% (Table 1).

*Trade Name

Table 1. Effect of varying levels of K in 'Delicious' apple leaves on Ca accumulation.

Percent dry weight basis

1960		1961		1962		1963	
K	Ca	K	Ca	K	Ca	K	Ca
1.44a[1]	.71b	1.31a	.63b	1.41a	.69b	1.43a	.65b
1.87b	.66ab	1.75b	.59ab	1.97b	.63b	1.73b	.58ab
2.07c	.62a	1.91c	.54a	2.21c	.57a	1.96c	.56a

[1]Means in the same column followed by different letters are significantly different at the 5% level.

The data in Table 1 show that there were differences in leaf K among all three K levels in 1960 through 1963, but only the highest level (2.07, 1.91. 2.21 and 1.96%) significantly decreased the accumulation of Ca in the foliage. It is doubtful that K levels of 1.90% or more are common in 'Delicious' trees in grower orchards or that high K levels have been a major factor in the increased incidence of cork spot and bitter pit in 'Delicious' apples in our orchards. The Ca levels in Table 1 are much below the 1.5% or higher optimum level established by some states for Ca. However, as shown in the Pomological Paragraph that follows, low Ca levels have been and continue to be common occurrence in Massachusetts.

****

POMOLOGICAL PARAGRAPH

Low calcium (Ca) levels have prevailed for many years: When the leaf analysis service for apple growers was initiated in 1956, we established for the major elements what was considered to be the desirable mineral content of leaves from bearing 'McIntosh' apple trees. For leaf Ca, 0.90-1.40% per weight was suggested as being optimum. Since 1956, leaf Ca has been consistently low in our 'McIntosh' apple trees (Table 1), but we paid little attention to this element except for stressing the need of lime.

Table 1. Ca content of 'McIntosh' apple leaves, expressed as % dry weight, from growers' orchards.

Year	Avg. % Ca	Range in % Ca
1956	.80	.61 - 1.04
1957	.92	.61 - 1.33
1958	.82	.49 - 1.52
1959	.95	.62 - 1.90
1960	.89	.37 - 1.60
1961	.89	.50 - 1.46

Year	Avg. % Ca	Range in % Ca
1962	.90	.56 - 1.30
1963	.98	.51 - 1.80
1964	.97	.59 - 1.30
1965	.96	.50 - 1.80
1969	.95	.78 - 1.30
1971	.76	.48 - 1.17
1972	.80	.43 - 1.33

In the last several years, it has been shown that this "neglected" element is very essential in apple trees. It is now believed that the leaf Ca should be 1.25 - 1.50% or higher in apple trees. Therefore, it is obvious that Massachusetts apple growers are faced with the problem of increasing Ca content of their apple trees. Unfortunately, at the present time, there is no quick and sure remedy for correcting low Ca levels.

****

CONTROLLING WEEDS IN STRAWBERRIES

Dominic A. Marini
Regional Fruit & Vegetable Specialist

Weed control is one of the major problems in producing strawberries. Weed killers can help to control weeds but cannot be expected to eliminate all cultivation, since a loose, open soil is necessary for runners to take root.

Chemical weed control is a useful tool, and like any tool, must be used properly for best results. Application equipment must be calibrated and in good working order so as to apply the proper amount of material uniformly. The soil surface should be smooth and free of clods. Chemicals used for pre-emergence weed control must be applied to clean, weed-free, moist soil followed by 1/2 to 1 inch of moisture within 3 or 4 days for best results. Weed population influences choice of material, since each controls some weeds and not others.

In Massachusetts, there are three materials suggested for weed control in strawberries in 1973. They are Dacthal* and diphenamid (Dymid* or Enide*) for pre-emergence use, and Tenoran*, which may be applied either pre-emergence or early post-emergence.

Dacthal* is the most versatile in that it may be applied immediately after planting and there is no limitation on the number of times that it can be applied, except that it may not be used during bloom and harvest. It is effective for about 4 to 6 weeks providing good control of crabgrass and other annual grasses, chickweed, purslane and lambsquarters. It does not control gal-

*Trade Name

insoga or cruciferous weeds, and is weak against ragweed and smartweed.

Diphenamid controls most of the weeds controlled by Dacthal* and is more effective against ones that Dacthal* does not control except galinsoga, and usually is longer lasting in its effectiveness. It should not be used until plants are established (about 2 weeks after planting) or injury may result. It may temporarily delay rooting of runners, but this should not affect yields. It should not be used on 'Raritan' since injury may occur. A second application may not be made within 6 months and it may not be applied within 60 days of harvest.

Tenoran* should not be applied until plants are established or injury may result. It may be applied either pre-emergence or post-emergence when weeds are less than 2 inches tall and grasses are less than 1/2 inch. It is weak against grasses, particularly as a post-emergence treatment, but controls most broadleafed weeds including galinsoga. Not more than 2 applications may be made in one year and it may not be applied within 60 days of harvest. Early spring applications the year of harvest are reported to have caused serious injury in New Jersey. Tenoran* remains effective longer than other materials. Some growers apply it after cultivation and hoeing in late May or early June and obtain good control for the rest of the season.

Cost of materials per application is roughly comparable, varying from $17.50 to $20.00 per acre (1972 prices) for the 3 materials. Regardless of cost considerations, perhaps the most important argument in favor of chemical weed control in strawberries is the difficulty of finding the time or labor to do the job by hand. As one grower remarked recently, "I wouldn't be in the strawberry business without weedkillers."

****

MUMMY BERRY

Dominic A. Marini
Regional Fruit & Vegetable Specialist

Mummy berry, caused by the fungus *Sclerotinia vaccinii-corymbosi* brought about losses in many cultivated blueberry plantings during the 1972 season. Prolonged cool, wet weather last spring provided ideal conditions for primary infection, the cause of the leaf and twig blight stage which resembles frost injury, and of secondary blossom infection which results in the mummified berries from which the name is derived.

Mummy berry is difficult to control in Massachusetts, where most blueberries are grown in sod. In New Jersey, where clean

*Trade Name

culture is practiced, mummy berry is seldom a problem in clean, well kept plantings, while it is a frequent problem in weedy, poorly kept ones. The reason for this is that frequent cultivation disturbs the mummy berries; those that are buried or lose contact with the soil fail to produce the spores that are the cause of primary infection. In addition to cultivation, New Jersey growers use ground applications of calcium cyanamid to destroy the "mummy cups" that develop from the mummy berries and release the primary spores. In Massachusetts, calcium cyanamid applications have not given satisfactory control, possibly because of the protection afforded the mummies by the sod cover.

Protective fungicide sprays are suggested for mummy berry control in Massachusetts. Timing is critical. Spores are released and infection takes place during wet periods from the time that the buds begin to swell until the blossoms have set fruit. The plants must be covered before wet periods during this time. Ferbam, at the rate of 3 pounds per 100 gallons, is the recommended fungicide. Make the first application when the buds have swollen and the earliest ones have begun to open, and repeat in 7 days. Spray again when the blossoms are in the close cluster stage and repeat 7 to 10 days later.

****

USE OF ETHEPHON (ETHREL*) TO INITIATE FLOWER BUD DEVELOPMENT

William J. Lord and Duane W. Greene
Department of Plant and Soil Sciences

Growers are interested in ethephon's ability to promote spur development and flower-bud formation on young apple trees. To induce this response, the proposed label gives the following directions:

"To increase flower bud development in both spur and non-spur type young non-bearing apple trees, apply a foliar spray of ETHREL* 1 to 2 weeks after peak bloom period (as determined by bearing trees in the area). On young trees <u>just beginning to initiate a few flowers</u>, treat 4 to 5 weeks after full bloom to minimize overthinning and mis-shapen fruit (calyx end pinched). Reduced vegetative growth and increased bud development during the season of application should increase flowering the following spring. Trees should be large enough to support a set of apples before they are treated to initiate flower buds.

1. Spur type trees: Mix 1-2/3 pints of ETHREL* in 100 gallons of water (5 pints in 300 gallons). Spray trees thoroughly and uniformly to the point of runoff.

*Trade Name

2. Non-spur type trees: Mix 3-1/3 pints of ETHREL* in 100 gallons of water (10 pints in 300 gallons). Spray trees thoroughly and uniformly to the point of runoff. This rate may completely defruit trees.

Treat when air temperatures are between $60^{o}F$ and $90^{o}F$."

Our studies show that concentrations much less than those recommended on the label for non-spur trees will reduce fruit set drastically when applied as late as 44 days after full bloom (F.B.). Therefore, until more is known about ethephon, we suggest it not be used on bearing trees to promote flower bud initiation if fruit thinning is undesirable.

We have conducted no trials with ethephon on non-bearing trees. However, research elsewhere indicates that if this chemical is combined with Alar-85*, it is possible to promote flower bud formation with lower rates of each chemical. Therefore, we offer the following suggestions for trial by those interested in initiating flower bud development on non-bearing, non-spur type trees. Mix 1-2/3 pints of ethephon plus 1 lb. of Alar-85* in 100 gallons of water. Apply this mixture 1 or 2 weeks after F.B. (as determined by bearing trees in the area). Suppression of vegetative growth should occur during the season of application as well as increased flower bud formation.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

---

*Trade Name

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

—

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S.M

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 38 (No. 3)
MAY—JUNE, 1973

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

PROGRAM PLANNING FOR NEW ENGLAND FRUIT MEETINGS

As in previous years, the Program Planning Committee for the New England Fruit Meetings will be held in mid-June. Each New England State is represented on the committee by its Fruit Extension Specialist and President of the Pomological or Horticultural Society. The committee members would appreciate suggestions for speakers and/or topics for 1974 meetings.

****

CHEMICAL THINNING OF APPLES

This spring we anticipate a heavier bloom and a potentially larger crop on many of our apple trees than in 1972. This means that chemical thinning will be desirable if good pollinating weather prevails at blossom time and a late spring frost is not a serious threat . Some moderate thinning of heavy setting McIntosh is usually necessary to assure annual flowering. This is a much more important reason for thinning McIntosh in Massachusetts than the necessity for improving fruit size. To the contrary, heavy setting 'Delicious' and many other early and late maturing apple varieties need chemical thinning not only to improve chances of annual flowering but also to significantly improve fruit size. With 'Delicious', it is desirable to delay the decision to thin as late as possible because too frequently this variety in spite of a heavy bloom may set only a light crop.

Chemical thinning has been a standard procedure in orchards for many years and except for testing a new chemical as a possible peach thinner and determining the effect of Alar* treatments on the response of 'McIntosh' apple trees to chemical thinning, our research work in this area has been limited.

Our study with peaches in 1971 showed that the new chemical had thinning capability but caused severe foliage injury, therefore this work was discontinued. The experiments with Alar* showed that a mid-August treatment at 2000 ppm in 1971 retarded abscission of young fruits when counts were made 11 days after petalfall in 1972. In spite of this carry-over effect of Alar on fruit set, it had no influence on the ability of carbaryl (Sevin*-50% WP), NAAm (naphthaleneacetamide), NAA (napthaleneacetic acid) or a combination of carbaryl plus NAA to reduce fruit set when applied at petal fall plus 17 days. NAA at 10 ppm or the combination spray of NAA at 10 ppm plus 1/2 lb Sevin* - 50% WP seriously overthinned. The milder materials, Sevin* - 50% WP at 1/2 lb or NAAm at 50 ppm, gave the desired degree of thinning.

Details concerning chemicals, concentrations and timing for thinning several apple cultivars are given in the following chart.

---

*Trade name

SUGGESTIONS ON USE OF CHEMICAL THINNERS ON SEVERAL APPLE CULTIVARS

Cultivar	Materials[1] Sprays	Materials[1] NAA Dusts	Time of Application [days after petal-fall (PF)]	Remarks
Early				
Gravenstein Red Astrachan	10 ppm NAA[1] or 25-40 ppm NAAm	0.1%	Late bloom to PF	If this is done several days after PF, the set may be increased and some fruit splitting may result.
Early McIntosh	20 ppm NAA or 50 ppm NAAm	0.2%	7-14	For more thinning use NAAm at PF plus NAA 10 to 14 days later.
Puritan	½ lb carbaryl[2]		PF-10	Young trees should not be chemically thinned since they probably will not overset. Thinning may not have much effect on repeat bloom
Milton	15 ppm NAA or 25-40 ppm NAAm	0.2%	7-14	Carbaryl has not been tested on this variety.
Mid and Late Season				
Cortland Macoun McIntosh	½ lb carbaryl or 5-10 ppm NAA or 25-40 ppm NAAm	0.1%-0.2%	7-14	Carbaryl and NAAm are mild thinners and less apt to overthin than NAA. Carbaryl and NAAm at the rates suggested will adequately thin McIntosh trees sprayed with Alar* the previous year.
Delicious	½ lb carbaryl		7-14	Carbaryl is the best material available for 'Delicious.'
Golden Delicious	10-15 ppm NAA	0.2%	7-14	NAAm and carbaryl may not thin Golden Delicious adequately.

[1] NAA and NAAm represent naphthaleneacetic acid (or its sodium salt) and naphthaleneacetamide, respectively

[2] 50% wettable carbaryl (Sevin*) per 100 gallons of water.

INTEGRATED PEST MANAGEMENT OF APPLE INSECTS, 1972

G.L. Jensen, E.J. Blyth and A.W. Rossi[1]

"Integrated pest management" is receiving a great deal of attention these days. New integrated techniques can, and in some instances have, proven to be economical and effective control measures. A desirable and highly popular characteristic of integrated pest management programs is the supplementation of current chemical controls with other more environmentally acceptable techniques. The use of such techniques will hopefully help solve the dilemma of a need for increasing food production while, at the same time, maintaining and preserving environmental quality.

In light of these needs, an integrated pest management program was initated at the University of Massachusetts Horticultural Research Center at Belchertown. In 1971, a standard spray program was applied to a segment of the orchard; however, only alterate rows were sprayed. Thus only half the usual amounts of pesticide was applied to the block. A subsequent check for insect and disease damage to the fruits from this block, as compared to the regularly sprayed blocks, indicated that this method had definite promise.

In 1972, a block of trees at the Horticultural Research Center was divided into three equal parts. On one-third of the block, the pesticide sprays were applied with a Kinkelder low-volume sprayer, using a standard spray program. Fifteen spray applications were made: 3 of fungicide only, 1 fungicide-oil combination, 10 of an insecticide-fungicide combination, and 1 insecticide-miticide combination.

The second one-third of the block was sprayed with the same machine and materials on the same dates, except that only alternate rows were treated, i.e., the rig was drawn between rows 1 and 2, 3 and 4, 5 and 6 etc., with the machine spraying from both sides. For the next application, the rig was drawn between rows 2 and 3, 4 and 5, etc. Thus, only half of each tree was sprayed during each application. This pattern of spraying supposedly provides an unsprayed haven for the parasites and predators which are generally more mobile than their prey. After spraying, the beneficial insects are able to move to the unsprayed portion of the trees and avoid being killed. As predator and parasite populations increase, fewer pesticide applications should be necessary.

The pesticides on the remaining third of the block (limited spray) were applied only when it was deemed "necessary", i.e., when insect pressures were considered to exceed the economic threshold level. As a result, only 11 pesticide applications were made, and

---

[1]Extension Entomologist, Graduate Student, Department of Entomology and Orchard Foreman, respectively

only 4 of these were insecticide-fungicide combinations. Five fungicide sprays were applied, while 1 oil-fungicide combination and 1 miticide (Kelthane*) application were made, the latter being applied in mid-August.

The insecticides used in the regular spray and alternate spray plots were Guthion*, Imidan* and Zolone*, while only lead arsenate and the fungicide Captan were used in the limited spray plot after the 1/2" green stage of development. These last two materials are recommended by integrated control specialists as being among the least detrimental (of all the available registered materials) to the natural enemies of insects and mites normally found in apple orchards.

Insect and mite population levels were monitored carefully throughout the growing season, both within these three treatments and in an abandoned orchard 1-1/2 miles away. Pheromone (sex attractant) traps were used to monitor codling moth, lesser apple worm, red banded leaf roller and oriental fruit moth populations. Apple maggot population levels were monitored with bait and visual attractants. The plum curculio was monitored by beating the branches over a 30" x 30" beating sheet for a specified length of time, and mite counts on the leaves of several trees were made routinely. Aphid populations were monitored by visual observations of the terminal foliage.

Aphids and other pests were noticeably more numerous in the limited spray plot than in either the alternate-row-sprayed plot or the regular sprayed plot; however, the numbers of beneficial insects were also noticeably higher in this plot. Insect levels in the abandoned orchard naturally exceeded those in the treated orchard. Mite counts (including predaceous mites) were also considerably higher in the limited spray plot than in the others. Although the predaceous mites were apparently beginning to get the upper-hand over the red mites in this plot, the blister mites were so numerous (300+/leaf) that Kelthane* was applied on August 15.

Representative samples of randomly selected Red Delicious and McIntosh apples taken from the centers of each plot were graded at harvest for insect injury. The tarnished plant bugs were responsible for the most common type of injury (1.1%), while red-banded leaf rollers (0.7%), apple sawflies (0.5%), and plum curculios (0.34%) all exceeded the codling moth (0.22%) in total number of fruits injured by insects (3%). Apple maggots were not discovered in any of the fruits examined, and many other additional fruits were examined without any evidence of apple maggot injury. An encouragingly high per cent of the fruits were clean in both the limited-spray (95.1%) and alternate-row-sprayed plots (97.4%). The latter results compare favorably with those obtained in 1971 in the alternate row experiment at the research center. The fruit sample from the regular spray plot revealed them to be 99.3% clean in 1972, with only a few injuries caused by the tarnished plant bug and plum curculio.

---

*Trade name

Summary

Although the results we obtained both in 1971 and 1972 are encouraging, and would seem to indicate that growers can through a carefully monitored program eliminate a few spray applications without serious loss of quality or quantity, we are not as yet prepared to recommend a reduced spray program on a wide scale. Insect and disease pressures vary from orchard to orchard and in order to successfully employ a reduced spray program without risk to quality and quantity, much information concerning insect and mite population levels (both beneficial and otherwise) is needed.

Further experimentation in this block and others is planned for 1973, and a more widespread survey of insect and mite fauna in several areas of the Commonwealth will be conducted. Hopefully, the information gleaned will enable us to better establish economic injury levels and to better manage insect and mite populations in the future without endangering our environment in the process.

****

WOODCHUCKS IN ORCHARDS

Edward R. Ladd, Wildlife Biologist
U.S. Fish & Wildlife Service

With the advent of spring, the largest member of the squirrel family, the woodchuck, will be making its appearance. Originally, the Eastern woodchuck was believed to be a forest animal. Like several other animals, it evidently has taken advantage of man's endeavors and now can be found near or in clearings, meadows, fields, and cultivated farmlands.

To the fruitgrower, the presence of this animal in his orchard may pose a problem due to the injury it inflicts on trees. Visible damage, although slight, usually is limited to the spring when the animal first emerges from hibernation and scratches and chews the lower trunks of trees. This activity is caused by the woodchuck's attempt to wear down his teeth that have continued to grow while he was in hiberation. Since his emergence is at a time when preferred green vegetation for food is scarce, some tree bark and buds may be taken.

Perhaps a more serious form of injury is caused by the woodchuck's burrow system if it is located at the base of a tree. In addition to aerating the root system, excavation of the tunnel removes soil necessary for supporting the tree and increases its probability of tilting and wind throw.

CONTROL METHODS

Shooting: Rifles with telescopic sights have encouraged the development of sport hunting of woodchucks. In recent years, there has been no closed season, nor any limit on the number of woodchucks that could be taken by individual hunters. If safety requirements are satisfied, landowners and their hunting friends can help reduce the number of woodchucks by using this method.

Gassing: If adequate relief from damage is not gained by hunting, or if safety requirements do not permit shooting, gas cartridges may be used. These are special cartridges for gassing woodchuck dens. Cardboard cylinders filled with slow-burning chemicals are burned to produce sulphur dioxide and carbon monoxide gasses. When the chemicals are ignited by a fuse and the gasses confined within the burrow system, lethal amounts accumulate and control is affected. Since a burning material is involved, it is wise to take care not to set fire to dry grass or brush. Gas cartridges should not be used in dens near abandoned sheds and buildings. Cartridges may be available at farm supplies stores.

Trapping: In addition to shooting and gassing, trapping may be employed to reduce woodchuck populations. The chuck may be taken with the regular #2 steel trap, or with a box trap made of wood and wire mesh.

****

POMOLOGICAL PARAGRAPHS

Timing of calcium sprays: There have been some questions about timing of calcium (Ca) sprays for the reduction of cork spot and bitter pit. According to Dr. Miklos Faust, USDA, cork spot develops in July and is located deep in the flesh; therefore, to control this disorder, early sprays of Ca are necessary. To decrease severity of bitter pit, the grower has the option of applying the sprays early to increase the Ca level of the entire fruit or applying them late to increase the Ca level in the cells just beneath the skin. 'Delicious' apples are susceptible to both bitter pit and cork spot, while on our other varieties, bitter pit is the main Ca disorder. Since our varieties frequently are interplanted, and it is more convenient to spray all varieties at the same time, most growers should start applying their Ca sprays approximately 2 weeks after petal fall.

Carbaryl (Sevin*) for thinning: There seems to be confusion among some growers concerning the rate of carbaryl (Sevin*) for thinning. Our Chemical Thinning Circular suggests 1/2 pound of carbaryl. The confusion lies in whether or not this means 1/2 pound actual carbaryl or 1/2 pound of Sevin* W.

The rate suggested in the thinning circular is based on Sevin* W. This means a grower will use 1/2 pound per 100 gallons of Sevin* 50W (which is equivalent to 1/4 pound of actual carbaryl).

****

COMPARATIVE RESPONSES OF PEACH TREES TO CHEMICAL WEED CONTROL, HAY MULCH, FREQUENT MOWING AND CULTIVATION

W.J. Lord and Edward Vlach
University of Massachusetts

A study of 6-year duration was recently completed in which the influence of paraquat, paraquat-plus-simazine, frequent mowing, hay mulch and cultivation treatments on growth, yield and nutrition of 'Jerseyland' peach trees were compared. The data obtained in this study indicated that:

1. The growth and yield of trees which received annually 2 applications of paraquat or 1 application of a paraquat-plus-simazine mixture were comparable to the trees maintained under cultivation or mulched annually with a 40-lb bale of hay.

2. Annual grassy and broadleaf weed were not as readily controlled by the residual simazine in the soil from the annual applications of the paraquat-plus-simazine mixture in early May as by 2 applications of paraquat annually in early May and-mid-July.

3. There is concern about complete elimination of weed cover under fruit trees with herbicides. With no snow cover, a soil free of weeds might expose fruit trees to a deep soil freeze and root injury. Complete control of perennial grasses and broadleaf weeds was not obtained. In addition, annual grassy and broadleaf weeds generally invaded the herbicide-treated areas and by late summer the weed population frequently was as dense as under cultivated trees.

4. An annual application of a 40-lb bale of hay resulted in peach tree performance comparable to cultivation. Hay mulch increased leaf potassium (K) in comparison to the other treatments and high leaf K was associated with depressed magnesium levels.

5. Trees that were mowed 4 or 5 times during the growing season generally were lower in nitrogen, made less growth and produced less fruit than the other treatments. These trees were probably more sensitive to periods of moisture stress, as indicated by trunk circumference increase.

6. Herbicides present the opportunity for peach growers to replace cultivation with an economical minimum tillage practice.

****

BROWN ROT OF PEACHES, PLUMS, CHERRIES AND OTHER STONE FRUITS

C.J. Gilgut
Department of Plant Pathology

Brown rot is the most destructive disease of peaches, plums, cherries and other stone fruits in Massachusetts. It causes blossom blight, spur blight, twig blight, stem cankers and it rots fruit on the tree and after harvest. Some varieties are more susceptible than others.

Disease Cycle

Brown rot is caused by the fungus, *Monilinia fructicola*, which overwinters in cankers, on twigs and branches, and in hanging mummied fruit on the tree and in mummies of fruit which fell to the ground and rotted. In the spring, about the time new growth develops and blossoms start to open, the fungus grows on the surface of the cankers and mummied fruit in the tree as a fuzzy grayish mold and produces large quantities of dust-like spores called *conidia*.

Spores are also produced in spring by the mummies of fruit on the ground - but in a different way. The fungus does not produce spores directly, as it does on cankers and mummies in the tree, but first produces tiny funnel-shaped, mushroom-like fruiting bodies - shaped like a champagne glass. The inside of the cup of the fruiting body is lined with spore-forming tissue which produces dust-like spores, called *ascospores*, which are released into the air in puffs as tiny visible clouds when conditions are favorable.

Both kinds of spores, conidia and ascospores, are carried by wind and air currents, and splashed by rain to different parts of the tree and to other trees where they germinate and grow into tree tissues when trees are wet during rainy or humid weather - and this can happen in a few hours.

Control

For satisfactory prevention and control of brown rot, it is important for one to keep in mind the following facts:

(1) The source of spores for infection is twig and stem cankers, mummied fruit in the tree and mummied fruit on the ground. Sanitation - picking up rotted fruit on the ground and in the trees, and removal of stem cankers - reduces the spore load in the orchard.

(2) Spores germinate and cause infection when trees are wet in 6 to 7 hours at 45°F; in 3 hours at 70°F. To get protection, the fungicide must be applied before the rain or, if necessary to spray in the rain, before the time for infection at the prevailing temperature goes by.

(3) There are two critical times when special attention must be given for brown rot control: (a) during blossoming - to protect against blossom blight, spur blight, twig blight and stem canker, and (b) during ripening and harvest - to protect against fruit rot. During these times there are usually rains which keep the trees wet and favor disease development.

(a) Blossoming period - pink, bloom, petal fall.

Protection at this time not only prevents serious disease development early, but is important for controlling fruit rot at the end of the season. The number of fungicide applications needed depends on rains and varies from year to year. The first application may be in pink, early bloom, mid-bloom or later. Repeat applications may be needed at 3 to 5 day intervals to protect blossoms that opened and new growth that came out since the previous spray and to replace the fungicide washed off. The pistil tip (stigma) and wilting and dying flower parts are particularly susceptible to infection. In prolonged rainy weather, an application in shuck-split and again in shuck-fall may be necessary.

Fungicides are usually applied as sprays but may be applied as dusts in emergencies when protection is needed and the time is short. Satisfactory fungicides in sprays are dichlone, 50% WP, 1/2 lb; wettable sulfur, 95%, 5 lbs; captan, 50% WP, 2 lbs; benomyl, 50%, 1/2 lb; and thiram, 65%, 2 lbs in 100 gallons of water. Dichlone has some "kickback" effect - about 12 hours - when applied to wet trees. Captain, especially when used with malathion, may cause some leaf injury and "shot-holing" when applied to tender young leaves on some varieties.

Growers should read labels for dosages, use suggestions, and precautions.

(b) Late season, pre-harvest, and harvest control

Immature fruit during mid-season usually do not rot unless there is a great deal of wet weather but should be sprayed for scab control.

Fruit becomes increasingly susceptible as it starts to ripen and mature and during harvest. There can be considerable fruit rot in the trees if weather is rainy and wet unless the fruit is well-protected with fungicide

and rot can continue in harvested fruit before and after it is marketed.

Fungicide applications should start about three weeks before harvest and be repeated as needed until fruit is harvested. A repeat spray may be 7 days or longer after a previous spray if there is little or no rain or 3 to 5 days if there is much rain. The fruit should be protected at all times during this period. It is no time to take chances.

Satisfactory fungicides, with pounds to 100 gallons of water and with days to harvest (dh) or no time limit (NTL) when last application is allowed, are: Captan, 50% WP, 2 lbs (NTL); thiram, 65% WP, 2 lbs (7dh); sulfur, 95% WP, 5 lbs (NTL); and benomyl, 50% WP, 1/2 lb (NTL).

Sulfur applied closer than 10 days to harvest may leave objectionable residue. No more than two sprays of benomyl should be applied during this period.

Rhizopus rot (a grayish black mold) causes rot of harvested fruit. Botran*, 75% WP controls it but does not control brown rot. Both rots - brown rot and Rhizopus rot - can be reduced on harvested fruit if the last spray on the tree, 1 to 3 days before picking, is a mixture of captan, 1 lb plus benomyl, 1/2 lb, plus Botran*, 2/3 lb.

Harvesting Suggestions

The hand which touches or handles a fruit with brown rot tranfers spores to healthy fruit handled later and increases post-harvest rot.

Fruit picked into new baskets will not become contaminated by the containers, but containers that are used over and over again will become contaminated with spores and will increase post-harvest rot. Decontaminate them by dipping or spraying them, inside and outside, with captan, 2 lbs to 100 gallons of water, at the beginning of each day they are used.

---

*Trade name

****

POMOLOGICAL PARAGRAPH

Influence of timing of bee hive introduction on production of highbush blueberries: The relationship between the time when bee hives were brought into the planting and the productivity of 'Jersey' blueberry was studied by G.S. Howell et al. at Michigan State University, East Lansing, and reported in Volume 7 (No. 2) of Hort Science. Their findings suggest that early pollination is asso-

ciated with increased yields and fruit size. Based on these findings, they suggested that blueberry growers using honey bees for pollination should place the hives in their plantings by no later than 25% of full bloom.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 38 (No. 4)
JULY–AUGUST, 1973

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

PRELIMINARY SUGGESTIONS FOR THE USE OF ETHEPHON (ETHREL*) ON 'McINTOSH' APPLE TREES

W.J. Lord and D.W. Greene
Department of Plant and Soil Sciences

A new compound, 2,chloroethylphosphonic acid (ethephon), if used correctly, could be of significant value to both producers and consumers of apples because a preharvest application of this material will stimulate red color development, increase soluble solids and hasten fruit maturity. These responses make it possible to advance the marketing season of 'McIntosh' apples and to have high quality fruits for these early sales. To the contrary, mis-use of ethephon and/or an unavoidable delay in harvest following its use could intensify our current problems of supply management and poor fruit condition. The placement in marketing channels at or shortly following harvest of excessive volume of ethephon-treated apples that must be sold quickly because of over-maturity, could cause distress selling. The storage of over-ripe ethephon-treated fruits would intensify one of the most serious problems of the apple industry--too many fruits in poor condition placed on the fresh market. Ethephon must be used with caution! Countless man-hours of grower and researcher time have been devoted to development of methods for growing high quality fruits and maintaining this quality in storage. Let's not take a step backwards.

What ethephon does.

A single application of ethephon applied 2-3 weeks before normal harvest at concentrations ranging from 1/4 to 1 pint per 100 gallons of water (assuming 400 gallons of spray mixture per acre at 1X) will increase red color development within 7 days after application. Fruit color will continue to increase at a faster rate than on non-sprayed trees. This response is accompanied by fruit flesh softening; the degree of softening is associated with the concentration of ethephon applied and number of days from application to harvest of the treated fruits. 'McIntosh' fruits sprayed with only 1/12 pint of ethephon may be excessively soft 21 days after treatment, being suitable for immediate use only.

Ethephon applied alone rapidly accelerates fruit drop. Therefore, napthaleneacetic acid (NAA) or 2,4,5-trichlorophenoxypropionic acid (2,4,5-TP) must be used to counteract the abscission effect of ethephon. A single application of NAA is effective for only 7-10 days. Therefore, its use may involve 2 applications of NAA and the risk of unfavorable weather which may delay the second application or picking. The 2,4,5-TP may cause more ripening than NAA, but it does eliminate the chance of excessive fruit loss following an ethephon application

---

*Trade name

A mid-July application of Alar-85* on trees scheduled to receive ethephon is of benefit. Although Alar-85* is ineffective for drop control on ethephon-treated trees, it will help maintain fruit-flesh firmness.

Successful use of ethephon. Ethephon will not completely overcome conditions unfavorable for development of red color. Factors normally associated with poor fruit color, such as high temperatures, excessive vigor, or dense trees, will adversely affect the percentage of fruit having 50% or more red color following an ethephon application. Therefore, ethephon is most useful on young trees of medium vigor or well-pruned, medium sized trees of moderate vigor from which a high percentage of well-colored fruits are normally harvested in one picking. Large dense trees will have many ethephon-treated fruits in their interior with inadequate red color. By the time these poorly colored fruits obtain adequate color they will probably be too soft and thus suitable only for juice or immediate sale.

Ethephon should not be applied earlier than 3 weeks prior to normal anticipated harvest because fruit quality could be reduced. Apply the ethephon-stop-drop spray combination when good drying conditions are anticipated for at least 12 hours after spraying. For best results, thorough coverage of the fruits and leaves is needed.

Good sprayer calibration is essential to insure uniform coverage and to avoid over-application. Apply ethephon at 1X and use no spreader-sticker.

Basically, there are 3 time periods for sale of ethephon-treated fruits--prior to normal harvest time, during normal harvest, and from storage until January 1. The volume of fruits sprayed with ethephon should be based upon anticipated sales during one or more of these sale periods. The harvest of ethephon-treated fruits must not interfere with the timely harvest of fruits for CA storage since at present the placement of ethephon-treated fruits in this type of storage is not recommended. Limited data show that ethephon-treated fruit which still are in good condition will store satisfactorily in CA but we are concerned that apples not in good condition will be stored.

Fruit to be placed in storage at 32^{o}F must be picked at proper maturity. Fruits to be sold through January 1 should receive no more than 1/4 pint of ethephon per 100 gallons of water (See Table 1) and be harvested 7-10 days after treatment. Although these fruits should store well until January 1, they will be softer than Alar-treated fruits.

Suggestions for use. In the table below are our suggestions for ethephon use. Ethephon should prove beneficial particularly for early season sales if used properly. Don't over-apply and use only on a trial basis since we need more experience with this compound under commercial usage.

Table 1. Suggested use of ethephon on 'McIntosh' apple trees.

Purpose	Compound, timing and rate
Sales prior to normal harvest	Alar-85* - mid-July - 1 lb/100 gals. plus ethephon - 2 to 3 weeks prior to normal harvest - 1 pint/100 gals. plus 2,4,5-TP - same timing as ethephon spray - 20 ppm
Fruits to be held at 32^{0}F in air for 1 month or less	Alar-85* - mid-July - 1 lb/100 gals. plus ethephon - 2 weeks prior to normal harvest - 1/2 to 2/3 pt/100 gals. plus NAA or 2,4,5-TP - same timing as ethephon spray - 20 ppm
Fruits to be held at 32^{0}F in air as late as Jan. 1	Alar-85* - mid-July - 1-1/2 lb/100 gals. plus ethephon - same timing as ethephon spray - 1/4 pt/100 gals. plus NAA or 2,4,5-TP - same timing as ethephon spray - 20 ppm

****

SUMMER CARE OF FRUIT TREES

William J. Lord
Department of Plant and Soil Sciences

Research findings and grower experience both show that tree training along with other cultural procedures is essential to the success of medium or high density planting. For the last several years, there has been greater emphasis on year-around care of compact trees. Below are suggestions of Dr. Robert Carlson, Michigan State University, that appeared in the July, 1972, issue of Compact Fruit Tree, on the summer care of compact trees.

Once over, once-a-year is a thing of the past in successful fruit culture. The modern orchard made up of compact trees in a medium or high density arrangement requires season to season attention rather than year to year observation.

Dormant Care: Since late fall, winter and early spring can be a "slack season" in fruit growing, these are good times to get some of the major tree training and pruning chores done. However, that is not enough to satisfy conditions for a well-trained or well managed orchard. To be sure, the basic tree forms can be established in the dormant season by branch spreading and tying, elimination of poor branches, "hold" pruning, tipping, etc., but a follow-up summer program puts the finishing accomplished touches on the trees.

Summer Care: During June and July, both non-bearing and bearing apple trees can be "shaped up" by eliminating excess shoot growth. This can be done in two ways. First, by removing shoots which grow upright and are so vigorous that they compete with fruiting wood. Twin shoots originating at one point should be reduced to one leaving the best positioned one for future bearing wood.

Secondly, rather than eliminating an entire shoot (1973 growth) pinch or cut it back leaving 2 or 3 buds at the base. This satisfies two conditions of the tree:

1. Growth control by adjusting total leaf surface and by providing uniform light exposure.
2. Creation of a more compact fruiting tree in a predetermined density.

Summer care can also include shaping trees by making one or two major cuts eliminating branches which for some reason are not productive or perhaps crowding other more fruitful branches. In fact, pruning cuts in older wood heal rapidly in the summer.

Sucker Removal: Summer orchard care also includes the removal of sucker growth that can be abundant due to major pruning cuts in the dormant season. These suckers should be pulled off rather than cut off, because re-growth is less by so doing. An occasional sucker (shoot) can be left as a potential fruit branch replacement for an older branch or to fill in a non-productive part of the tree. In compact and intensive fruit plantings, it is important to maintain the trees fruitful on young active branches. In other words, do not hesitate to eliminate larger branches in preference to branches which fruit closer to the trunk.

Central Leader Care: Summer also is the time to prevent the loss of leaders because of heavy fruit loads. This is especially important until the tree is large enough for a particular tree density. So, it is best to remove all fruit from the top one-fourth of the leader. When the tree has reached its ultimate height, the leader can be allowed to fruit and flex over to one side.

Incidentally, the central leader in a compact tree bears annual watching. When it becomes overly vigorous, head it back to a

weak lateral branch. This can be done either in the dormant season or in the summer. A keen eye can catch what should be done and a quick hand can correct it before it is too late.

Check Your Trees: Grass and weeds next to the trunk of young and old trees can set up a condition favorable to collar rot. In this case, the trunk near the ground line remains moist 24 hours a day. Remove the grass, weeds and decayed matter and then put a few shovels of coarse gravel or pea gravel around the trunk and top of the soil. Do not make a saucer around the trunk.

Soils high in clay are more prone to collar rot so avoid sites having high clay content. Rootstocks vary in tolerance to collar rot; however, inadequate orchard management can lead to trouble with both vigorous and dwarfing apple rootstocks. M. 7 is apparently more resistant to collar rot than MM. 106. However, rootstocks (such as M. 7, 9, and 26) which are budded high and planted deeper in the orchard require extra care around the trunk base. Furthermore, best insurance against problems of collar rot is to choose (if possible) a well-drained sandy loam as the site.

Phythophthora cactorum is one name associated with other factors and often referred to as 'collar rot', 'crown rot','root rot', 'trunk rot', 'bark rot', and winter injury, but all are not the same.

Factors that may be associated with collar rot are extreme low temperature at various times during the winter, and also, fluctuating or sudden changes in temperatures.

A white quick drying outdoor latex paint applied to the lower tree trunk will reduce temperature changes and lessen the chances of collar rot infections.

****

POMOLOGICAL PARAGRAPH

Firmness benefits from Alar: It appears that growers might expect a 1-lb firmness benefit on 'McIntosh' apples from a mid-July application of Alar-85* at the rate of 1-lb per 100 gallons of water. This assumption is based on a trial conducted in 13 orchards this past summer which involved spraying one side of 2 trees in each orchard with Alar-85*. The trees were sprayed on the same date and were harvested either September 19 or 20, and September 27, 1972. On both the earlier and later harvest dates, the Alar-85* sprayed fruits were 1-lb firmer than the check fruits. When removed from CA storage in early May, 1973, the Alar-85* fruit from the 2 picking dates were 0.9 and 0.6 lbs firmer, respectively, than the check fruits.

*Trade name.

1972 BLUEBERRY SURVEY

Dominic A. Marini, Reg. Fruit & Vegetable Spec.
Southeast Extension Region

A mail survey of Massachusetts cultivated blueberry growers was taken in Fall, 1972, to determine more clearly the nature of this industry. Objectives of the survey included determination of the varieties being grown, the market outlets being utilized, and the methods being used to reduce bird damage. Two hundred growers were sent questionnaires and 32% of these growers responded.

Size of plantings: Of the respondents, 32% have less than 100 bushes; 37% have 100-1000 bushes; 24% have 1000-5000 bushes; and 7% have 5000 or more bushes. Since, at the usual planting distance of 5 x 8 feet there are 1,089 bushes per acre, it is obvious that most plantings are small. It thus appears that in Massachusetts blueberries are grown primarily as a supplementary farm enterprise or else to supplement income of persons not purposefully engaged in farming.

Varieties being grown: The following table lists the different varieties reported, and the percentage of growers reporting each:

Jersey.....	40	Dixi.........	12	Adams.......	1
Berkeley...	36	Rancocas.....	11	Cabot.......	1
Coville....	33	Burlington...	8	Concord.....	1
Blueray....	32	Pemberton....	8	Early Blaze.	1
Earliblue..	27	Pioneer......	5	Early Dawn..	1
Bluecrop...	24	Bluetta......	4	GN 87.......	1
Collins....	20	Darrow.......	4	Ivanhoe.....	1
Herbert....	19	Stanley......	4	June........	1
Rubel......	19	Atlantic.....	3	Wareham.....	1
		Lateblue.....	3	Weymouth....	1

It is apparent that while the varieties that are currently recommended for Massachusetts (Special Circular No. 212-E) are the ones most widely grown, plantings vary greatly in their variety assortments.

Market outlets: Public picking was reported by 35% of the growers, 32% have their own roadside stands, 21% sell through local stores and other stands, 15% sell through wholesale markets, and 1% sell to bakeries. The industry is clearly retail-oriented, and the popularity of "Pick Your Own" among the growers is noteworthy.

Bird damage: Netting is the most commonly used method of controlling bird damage, with 69% reporting that they use it and 64% saying that it is effective. In commenting on the use of netting, 2 growers mentioned having trouble with raccoons tearing the net.

Only a few growers commented on the expense of netting, indicating that most people who use it feel that it more than pays for itself. Some growers use other bird control devices. Reflectors were reported by 11%, with opinion equally divided on its effectiveness. Exploders and scarecrows were each used by 5% of the respondents, and in both cases half of the users felt they were ineffective. One grower reported that 1 helium filled balloon per acre plus reflectors was effective against crows and starlings, but not against other birds.

****

POMOLOGICAL PARAGRAPH

Some cost figures on picking apples. In a study in the State of Washington, each foot of the ladder represented a reduction in picking rate of 0.4 of a box per hour. Pickers in dwarf tree orchards averaged 18.1 boxes per hour vs. 11.7 boxes on standard trees. This also affected their hourly earnings. On dwarf trees at 25¢ per box, pickers would have earned $4.52 per hour, and on standard trees, $2.92 per hour. The study also showed differences in picker efficiency. Experienced men pickers outpicked inexperienced men by 20% and experienced women by more than a third. However, in dwarf orchards, all pickers harvested at about the same rate.--L.D. Tukey, Penn. State. Hort. Reviews:21(No. 4), Oct. 1972.

****

STORING BLUEBERRY NETTING

Dominic A. Marini, Reg. Fruit & Vegetable Spec.
Southeast Extension Region

One of the time-consuming aspects of using netting to prevent bird damage to cultivated blueberries is putting up and taking down the net every year. This is done in order to minimize deterioration of the netting by sunlight and to prevent physical damage from wind, ice and snow. It involves unwinding the sections, placing them over the wires, sewing them together and securing the entire net in position. The entire operation is then reversed following the harvest.

With the introduction of lightweight polypropylene netting, two Massachusetts growers have found that it is no longer necessary to go through the entire procedure every year. Rather than dismantling and removing the net completely, they are storing it in

the field. This is done by unfastening the net and rolling it up into a long snakelike roll on top of the wire framework. The roll is covered with black plastic to protect the net from sunlight and tied in place right on the wires. This eliminates taking the net apart into small, easy to handle sections, rolling them up, and storing them until the next season. At one planting, the netting is being stored in the field in this manner for the second winter now with no noticeable harmful effects.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S. MAIL

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 38 (5)
SEPTEMBER—OCTOBER

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

CIDER NOTES

Kirby M. Hayes
Department of Food Science and Technology

A question that often arises is how to make good cider. Although there is no easy answer, or hard and fast rules, two of the most important factors to consider are maturity and variety.

Maturity

Firm, ripe apples---those that are ripe enough to eat out of hand--- make the best cider and give the highest yield. Immature or overripe apples lower the quality. Early-maturing varieties should be allowed to ripen sufficiently to yield a high-quality juice.

Variety

The best cider is usually made from a blend of different varieties of apples. A blend provides an appealing balance of sweetness, tartness, and tang, as well as aromatic overtones.

A single variety of apple seldom makes a satisfactory cider. However, 'McIntosh' has been used alone successfully, but only at the peak of its maturity.

Sometimes the desired fullness and balance can be obtained from two varieties. A blend of three or more varieties is better. Using several varieties, permits greater latitude in varying the proportions to obtain the desired blend, and also allows practical management of the available supply.

Many commercially important varieties may be separated into four groups according to their suitability as cider material: Sweet subacid, mildly acid to slightly tart, aromatic and stringent. A strict classification is not possible because many varieties have a number of different flavor characteristics. For example, 'Delicious' may be listed in both the sweet subacid and aromatic groups. Moreover, varieties differ in their characteristics from one area to another.

Varieties in the sweet subacid group are grown primarily for eating raw; they usually furnish the highest percentage of the total stock used for cider.

Varieties in the aromatic group have outstanding fragrance, aroma and flavor that are carried over into the cider.

Crabapples, in the astringent group, provide tannin - a constituent difficult to obtain in making a high-grade cider. The

juices of this astringent group also are highly acidic. Only a small quantity of these apples should be used in the blend.

Use the following list as a guide in selecting the right blend of varieties.

Sweet subacid group: Baldwin, Delicious, Cortland, Spartan, Empire, Macoun.

Mildly acid to slightly tart group: Winesap, Jonathan, Northern Spy, R.I. Greening, Roxbury Russet.

Aromatic group: Delicious, Golden Delicious, McIntosh, Empire.

By fitting the above suggestions to your operation, using sound clean apples, pressing in a clean mill, and storing and displaying the finished product under refrigeration, you can keep your customers coming back for more.

****

PUBLICATIONS AVAILABLE

A series of new publications that should be of interest to many apple growers is now available from Cornell University. These are:

1. "Refrigerated Farm Storages," Information Bulletin 16. ($1.00)

2. "Harvesting Fresh Market Apples in New York," Information Bulletin 49. ($.30)

3. "Controlled Atmosphere Storage of Apples," Information Bulletin 41. ($.30)

4. "Handbook for Controlled Atmosphere Rooms," July 1, 1973. (Free)

The first 3 publications may be obtained from: Mailing Room, Building 7 Research Park, Cornell University, Ithaca, New York 14850.

The fourth publication may be obtained from the Pomology Department, Cornell University, Ithaca, New York 14850.

****

SOME HANDLING AND STORAGE PROBLEMS OF 'IDARED'

R.M. Smock, Pomology Department
Cornell University

'Idared' is an attractive, high-yielding apple variety that resulted from a cross of 'Jonathan' and 'Wagener' in Idaho. In some areas it has been widely planted in recent years, with a reputation as a good-keeping apple with few storage problems. Reports of problems with internal breakdown of 'Idared' prompted an investigation of its characteristics in New York.

Picking maturity for storage: Most varieties soften at a fairly regular rate as they mature on the tree. This does not seem to be true of 'Idared.' Firmness changes during October of 3 different years appeared to be small and erratic. Furthermore, although 'Idared' gives the impression of being a "hard" apple, it gave surprisingly low pressure-test readings (generally between 12 and 15 lbs during October). Hence the pressure tester seems to be of little value in judging when to pick this variety.

One of the prime considerations for 'Idared' is taste. If picked too early, the apples have a bitter or astringent (puckery) taste. As the apples ripen in storage, much of this taste may disappear, but they should not be sold until it does disappear. Most of this bitterness disappeared from the fruit on the tree by mid-October in Ithaca, New York. Sugar content, as measured by "soluble solids," did not change at a regular rate during October, but values of 12-13% were recorded after mid-October and appeared to be satisfactory. This evidence indicates that the proper time for picking 'Idared' is probably right after 'Delicious' in New York.

Scald control: 'Idared' is somewhat susceptible to scald. If picked at the proper time the problem should be minimal, but for insurance 1800 ppm of Stop Scald (2 pints/100 gallons) or 1000 ppm of DPA (1 lb of dry, wettable DPA/100 gallons) would be our recommendation.

Jonathan spot: 'Jonathan' was one parent of 'Idared,' and like its parent this variety, especially if picked late, can develop Jonathan Spot in storage. However, if picked at the proper time, the problem should be minimal, and if stored in CA (3% O_2, 2% CO_2, 32^{o}F) the problem has not developed.

Freezing damage: Since this is a late variety, the danger of freezing in the orchard exists. In fact, freezing occurred in 1969 and in 1972. Samples that had been frozen were stored and observed. Freezing reduced their firmness at harvest, but in general the apples recovered remarkably well. Whereas varieties like 'Northern Spy' developed much breakdown by January, 'Idared' did not. However, by late spring they did show breakdown, testifying

to the rule that severely frozen apples should never be held later than is absolutely necessary.

Breakdown: 'Idared' can break down in a manner similar to the problem with late-picked, large 'Jonathan.' Fruit size in relation to breakdown was examined. Large fruit (78 fruit/box) had over 60% breakdown after storage, whereas smaller fruit (89-153 fruit/box) had little or no breakdown. Maturity was also examined, and fruit harvested at the end of October or early November had a much greater susceptibility to breakdown than those picked in mid-October. Limited evidence suggested that the fruit that broke down were low in calcium. Attempts to reduce breakdown with calcium sprays and dips have not succeeded to date.

****

DON'T DELAY THE HARVEST OF ALAR-SPRAYED FRUITS

William J. Lord
Department of Plant and Soil Sciences

In the July-August, 1973, issue of Fruit Notes, we mentioned that growers might expect a 1-lb firmness benefit on 'McIntosh' apple trees from a mid-July application of Alar-85* at the rate of 1-lb per 100 gallons of water. This estimate was based on a trial conducted in 13 orchards in 1972, which involved spraying one side of 2 trees in each orchard with Alar-85*. The trees were sprayed on the same date and were harvested either September 19 or 20, and September 27, 1972. On both the earlier and later harvest dates, the Alar-85* sprayed fruits were 1 lb firmer than the check fruits. When removed from CA storage in early May, 1973, the Alar-85* fruits from the 2 picking dates were 0.9 and 0.6 lbs firmer, respectively, than the check fruits.

This trial in grower orchards was such that the data could not be statistically analyzed. Therefore, it is not possible to determine if the 0.9 and/or 0.6 lb firmness difference after storage of Alar and check fruits was significant. However, data obtained in other experiments in 1971 and 1972 showed that the firmness difference of Alar-85* fruits harvested in the first picking persisted in storage whereas it disappeared if the fruits were picked 7 days later (Table 1).

Table 1. The influence of Alar-85* on flesh firmness of 'McIntosh' apples at harvest and following storage.[z]

Alar treatment in mid-July	Flesh firmness at harvest		Flesh firmness when removed from storage	
	First picking	Second picking	First picking	Second picking
1971	9/16	9/23	Stored until 12/13 at $32^{o}F$ in air	
1-lb/100	16.4a[z]	15.8a	13.5a	12.8a
0	15.6b	14.9b	12.6b	12.4a
1972	9/13	9/20	Stored 28 weeks in CA	
1½-lb/100	16.7a	16.0a	13.8a	12.3a
0	15.8b	15.3b	13.0b	12.0a

[z]Means within a column for any year followed by a different letter are significantly different at the 5% level.

The data show that growers should not be complacent about harvest of McIntosh because the trees have received Alar-85*. If you want to retain the firmness advantage imparted by the Alar-85*, the fruits should be harvested as early as possible. Secondly, when the fruits from non-Alar sprayed trees are unsuitable for CA storage, the same probably is true of Alar-sprayed fruits.

*Trade name

****

POMOLOGICAL PARAGRAPH

Soft McIntosh. R.M. Smock and G.D. Blanpied, Cornell University, designed an experiment in 1972 to determine if the 'soft McIntosh' problem encountered by New York and New England apple growers in the spring of 1969,1971, and 1972 might be associated with dry conditions during the summer followed by excessive rainfall just prior to harvest.

They withheld water from some trees for 2 months and then irrigated with 2-1/2 inches of water. 'McIntosh' apples from these trees and check trees were pressure tested for flesh firmness at monthly intervals after harvest. At each test period, the irrigated apples were softer than the check apples even though they were slightly smaller than the check fruits.

These findings appear to support the study of climatological data made by Dr. Blanpied which showed a strong correlation between soft McIntosh apples and dry periods in the summer followed by heavy rains and warm weather prior to harvest.

****

FREEZING OF APPLES: ITS EFFECTS ON CIDER PRODUCTION

P. Footrakul and S.W. Fletcher
Department of Food and Agricultural Engineering

Accidental freezing of apples, either in the orchard or during storage, is a fairly common occurrence. Does freezing of apples affect the yield or quality of cider obtained from these apples? This question has been raised, and we felt that perhaps freezing of apples might increase the quantity of juice produced per unit weight of apple used, since freezing breaks up the structure of cells in the fruit.

To investigate the effect of freezing on apples for juice production, last fall we carried out an extensive series of tests using both McIntosh and Delicious apples. In this study the primary emphasis was on the quantity of cider released, but consideration was also given to cider quality, optimal press load and pressing speed.

In the study, both varieties of apples were frozen for 24 hours at different temperature levels: 20°, 10°, 0° and -20°F. Before pressing, the samples were thawed and warmed to 70°F, and then the fruit were cut and ground to a standard size. A control that had not been frozen was removed from 35°F storage and allowed to reach 70°F before pressing. Samples were pressed in a specially designed cylinder on an Instron Universal Tester so that an accurate measurement of loading rate, force, and quantity of juice expressed could be obtained. Three different pressures were utilized, along with 2 different rates of loading (pressing). Measurements were made on the expressed juice samples for the total yield, sugar content, and color. The total yield results are summarized in Table 1.

As was expected, the higher the pressing load and the slower the rate of pressing, the greater was the yield of cider, whether or not the apples had been frozen. It can also be seen in Table 1 that Delicious apples yielded more cider than McIntosh apples.

The total yield results clearly show that freezing of recently harvested apples did not increase the yield of cider under most pressing conditions. In fact, freezing usually decreased yield,

sometimes quite drastically and especially with McIntosh. This effect of freezing was not consistent, however, in that the warmer freezing temperatures often caused more reduction of juice yield than the colder freezing temperatures; again this was particularly true with McIntosh.

Table 1. Yield of cider from apples that had been frozen to different temperatures.

Press pressure (lb/sq in)	Relative pressing rate	Temp. to which apples were frozen: Control	20°F	10°F	0°F	-20°F
		(% of total fresh fruit weight)				
		McIntosh				
64	Slow	54	33	38	39	35
127	Slow	57	40	46	51	53
225	Slow	59	--	59	69	67
64	Fast	46	19	21	27	28
127	Fast	49	25	31	37	39
225	Fast	52	--	43	46	44
Avg.		53	29	40	45	44
		Delicious				
64	Slow	61	61	53	52	53
127	Slow	65	63	56	56	58
225	Slow	64	68	60	61	66
64	Fast	55	46	40	37	42
127	Fast	60	51	42	40	44
225	Fast	59	55	43	45	48
Avg.		61	57	49	49	52

Yield reductions from frozen apples were avoidable, however. Use of optimum pressing conditions (high press pressure and slow speed) not only eliminated the yield reduction with both varieties, but actually appeared to increase the yield by using frozen apples. This raises the question of possibly freezing apples deliberately before pressing, in order to increase the cider yield. Such a procedure does not appear to be commercially practical, for not only did it require optimum pressing conditions, but also the possible increase in yield did not appear to be great enough to offset the cost of freezing. The importance of these observations is to emphasize that when apples that have been frozen are being pressed, it is especially important that optimum conditions of pressing be employed.

Does freezing affect cider quality? We found that sugar content of expressed juice was not affected by freezing itself or by the temperature to which the apples were frozen; neither was it affected by press load or pressing rate. Likewise, the tests

showed no significant difference in color of cider among the samples at the time of pressing. Therefore, we concluded that freezing of these 2 varieties of apples did not significantly affect the quality of cider yielded.

In summary, our tests showed that if apples become frozen, at least shortly thereafter they may be pressed for cider without a loss of cider quality. However, total yield will likely be reduced unless the press is being operated under optimum pressing conditions.

****

CARBON DIOXIDE LEVELS IN APPLE STORAGES

William J. Bramlage
Department of Plant and Soil Sciences

For most apple cultivars the CO_2 level recommended in a CA atmosphere is from 2 to 5%, and for some it is recommended that CO_2 be kept lower during the first month of storage than during the later months. There is now some indication that these may not be the best CO_2 conditions for apples.

In 1971, H.M. Couey and K.L. Olsen at the U.S.D.A. Laboratory in Wenatchee, Washington conducted an experiment on Golden Delicious apples, in which the fruit were treated with from 5% to 20% CO_2 for 10 days immediately after harvest. Some of these apples were ripened immediately thereafter and others were placed in regular CA until spring. Whether ripened immediately or stored in CA, those apples given the short CO_2 treatment right after harvest were significantly firmer than those that had not been treated.

In reviewing the literature, Couey and Olsen discovered that they were not the first to observe this response. During the mid-1940's, Dr. S.A. Pieniazek and his coworkers at the University of Rhode Island studied the use of CO_2 to control scald. Their results (Proc. Amer. Soc. Hort. Sci. 46:123-130; and 48:81-88) showed that treating a number of cultivars with from 25% to 60% CO_2 in air for up to 10 days immediately after harvest and then keeping them in regular air storage sharply reduced scald during and after storage. With certain cultivars, CO_2 injury developed in the core area. Injury was severe in Duchess and Yellow Transparent, but was only slight in McIntosh and did not occur at all in Cortland, Delicious, Northern Spy, and other cultivars.

These findings were never developed for commercial application to control scald because no practical means to generate these high CO_2 atmosphere was available at that time. By the time atmosphere generators were developed, chemicals were available for scald control.

An observation made in this work was that in every case, apples treated with CO_2 were firmer after storage than ones not treated with CO_2. These differences were usually sizeable, with the CO_2-treated apples usually being 1.5 to 3.0 lbs firmer. However, since the scald-controlling property of CO_2 was of greatest concern and could not be commercially applied, the effect of CO_2 on firmness was overlooked and had been forgotten.

We are very much interested by these results. We have been conducting some experiments of our own for several years using unusually high CO_2 levels in CA atmospheres and have found that high levels of CO_2 usually almost prevent softening in storage, even when CO_2 injury is abundant.

There is clear danger in applying high concentrations of CO_2 even for short periods. CO_2 can cause fermentation and off-flavors as well as cause characteristic fruit injury. Therefore, the interesting findings of firmness retention must be examined carefully before any commercial recommendations may be considered. Although a test last year at Cornell University by R.M. Smock and G.D. Blanpied found no benefit to Golden Delicious or Delicious apples from a brief high-CO_2 exposure, we think that this question needs more examination and intend to give it a great deal of attention in the near future. Our experience has been that apples are reasonably tolerant to CO_2, especially at low O_2 levels. Since many storage operators now have CO_2 generators available for use, it would be easy to apply the treatment, and if high CO_2 can cause appreciable retention of fruit firmness, major losses of fruit quality would be avoided.

****

POMOLOGICAL PARAGRAPHS

Cortland apples in 32°F CA. R.M. Smock and G.D. Blanpied reported in Cornell Fruit Handling and Storage Newsletter, July, 1973, that a few Hudson Valley growers have for a number of years successfully stored Cortland apples in 32°F CA. During the 1972-73 storage season, Smock and Blanpied conducted a study comparing Cortland apples harvested from a number of orchards and stored in CA at 32°F or 38°F. They found no difference in flesh firmness and a taste panel had no preference for Cortlands stored either in 32°F or 38°F CA. These researchers stated that they are almost ready to change the CA storage recommendations for this variety to either 32°F or 38°F. However, they suggest that all CA storage operators store a few boxes of Cortlands at 32°F this 1973-74 storage season in order to confirm previous years' observations.

***

<u>Arcat generators</u>. Atlantic Research Corporation of Alexandria, Virginia no longer sells or supplies parts for Arcat generators. Their patents and inventories of this equipment have been purchased by S.M.B. Corporation of Seattle, Washington who are now manufacturing their own line of generators. S.M.B. Corporation is represented on the East Coast by Doub Engineering Co., P.O. Box 2080, Falls Church, Virginia, 22042 (703-534-5978). In addition to supplying new generators, Doub Engineering Company supplies parts and servicing for Atlantic Research generators.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE
AGR 101

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 38 (No. 6)
NOVEMBER–DECEMBER 1973

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

CONTROLLING ORCHARD MICE

Edward R. Ladd, Wildlife Biologist
U.S. Fish and Wildlife Service

Unless preventive measures are taken, orchardists can expect mouse damage to fruit trees during the winter months. Most know from past experience which areas and blocks of trees are likely to be damaged. Still, it is a good idea to make a survey of the orchard in the fall to determine whether any new trouble areas have developed. Areas having clean mouse trails, chewed apples, or the characteristic fan-shaped mounds of soil, pushed up by pine mice, are potential mouse damage problems. These are the areas where a thorough mouse control program should be undertaken.

MEADOW MICE

These are the surface-living mice most common to orchards in the Northeast. They injure fruit trees by chewing bark from the root collar upward. Since these mice require food and shelter for survival, some protection can be gained by eliminating these two requirements. Control of grass and weeds in the orchard should be done periodically throughout the year, but especially in the fall. Close mowing and removing hay destroys cover and meadow mice are less active in these exposed areas. This should help prevent damage prior to snowfall.

Control of vegetation should not be used as the primary meadow mouse control method in the fall, but merely as a supplement to the use of toxic baits. Remember that during the winter deep snow will provide the needed cover for mice and they will be able to reach the trees without exposing themselves.

The best method for controlling orchard mice is still the use of zinc phosphide-treated grains--either oats or corn. These treated grains may be applied either with the trail builder machine or by broadcasting at a rate of 6-10 pounds per acre. All sections of the orchard having meadow mice should be treated in the fall. Those areas having an overabundance of mice will need an extra treatment, if the initial one does not give adequate control. Hand placement or a broadcast of Zinc Phosphide Rodenticide-treated apple cubes is a good follow-up method.

Periodic checks during the winter months, particularly after a thaw, may reveal spots still having meadow mouse infestations. A tablespoon of zinc phosphide-treated grain poured into the holes, may give added protection for the remaining winter months.

PINE MICE

Pine mice are an underground species found in many orchards in the Northeast. These mice damage trees by girdling the root sys-

tem. This form of injury is not readily apparent until the tree loses its vigor, the leaves take on a yellow cast, or sprouts appear from the damaged roots.

Control of pine mice is more difficult and seldom as effective as for meadow mice. The broadcast method of distributing poisoned baits recommended for meadow mice may eliminate a few pine mice but usually not enough for adequate protection. It should be noted that control of vegetation may not have any effect on pine mice because of their subterranean living habits.

To obtain good control, zinc phosphide-treated baits must be placed in underground trails where the animals spend most of their time. If the infested area is small, hand baiting of the pine mouse natural runways--using treated grains or apple cubes--is effective.

For larger areas, the use of the trail builder machine is an advantage if soil and sod conditions permit. Be sure the machine is aligned properly and is making a good tunnel through the sod. By making artificial trails on 2 or 4 sides of each tree, a great number of the pine mouse natural runs are intersected. Most of the commercially-available trail builder machines are equipped with automatic dispensers that put out 3-5 bait placements per each 20 feet of trail.

Whether an orchardist hand baits for pine mice or uses a machine, there is one absolute necessity: <u>the artificial trail and the natural runs must be kept as clean as possible</u>. Pine mice maintain clean, well-packed trails. They remove all foreign matter and debris, especially soil, from the tunnel. In the process, mice quite often will cover or carry out the treated bait with other materials.

<u>NOTE</u>: As in previous years, a permit for bait application must be obtained from the Massachusetts Division of Fisheries and Game, 100 Cambridge Street, Boston, Massachusetts 02202, before any orchard mouse control can be done using toxic baits.

****

HOW IS THE KEEPING QUALITY OF YOUR SWEET CIDER?

William J. Lord
Department of Plant and Soil Sciences

Too frequently, the author obtains sweet cider that has started to ferment or maintains its quality for only 2 or 3 days in the refrigerator. Undoubtedly, other consumers have experienced this problem and many potential repeat sales are lost. Consumers

want value for their money and it is reasonable for them to expect that sweet cider will maintain its quality for at least a week in the refrigerator.

Poor keeping quality appears to be most prevalent in late winter and spring, when cider is pressed less frequently. Apparently some growers store their cider under refrigeration for 2 weeks or longer and when the cider is displayed for sale and/or purchased by the customer, it has lost most of its potential keeping quality.

Kirby Hayes, Department of Food Science and Technology, had the following pertinent comments about cider quality in the September-October, 1971, issue of Fruit Notes.

"Consumers are becoming more critical of everything they buy --not only from a price aspect, but from a quality point of view. With living costs continually rising, consumers want value for their money. Quality in food refers to taste, appearance, color, cost per serving, and keeping quality.

Cider is not a necessary food item in most budgets. Cider is basically a beverage to be enjoyed, and if the quality is low or the keeping quality poor, repeat purchases can easily be eliminated.

Have you examined your cider critically as a consumer would? Take a half gallon and subject it to the conditions that the buyer does. Taste a glassful--is it musty? chlorine off-flavor? taste like dirty press cloths? insipid? Do this until the container is empty. Did it start to ferment? Did the last glass look and taste like the first? Or, go out and buy from several other stands, have your wife pour samples including yours in unmarked glasses--now taste and judge. If you pick your own as best, now try to maintain the year's run that way or even improve. If yours comes out second or third best, what is wrong? Remember, quality is a silent salesman!

The keeping quality of cider is directly related to the sanitation practices observed during the operating season. Unsanitary practices foster the growth of microorganisms, which cause fermentation or produce undesirable flavors in the final product.

After a day's run, observe the following procedures in cleaning the cider plant:

Dismantle the press for cleaning. Rinse it thoroughly with a hose to remove surface dirt. Scrub all parts of the press thoroughly, using a sanitizing or detergent-sanitizing solution. Where possible, use hot water for both the rinsing and the scrubbing operations.

Sanitizing compounds may be of the chlorine or quaternary ammonium types. Dairy-cleaning compounds are usually of these types, and they are easily obtained. Directions given by the manufacturer

of the solution for cleaning dairy equipment will be satisfactory for cider plants."

****

CONTROLLING DEER IN ORCHARDS

Edward R. Ladd, Wildlife Biologist
U.S. Fish and Wildlife Service

The white-tailed deer is of economic importance in the United States and annually large sums of money are spent by hunters in quest of this game animal. When food and cover are plentiful, deer do not range very far. They tend to stay in one area for long periods of time, moving only when food and shelter become inadequate or weather forces them to seek more favorable locations. In some areas, however, the local deer population may increase to a point where animals cause a great deal of damage by browsing on agricultural and forest crops.

REPELLENTS

Taste repellents offer one method of reducing deer damage to fruit trees. Under most winter or dormant season conditions, these materials have proved practical and effective. Three factors determine the effectiveness of a repellent: the animal's appetite; weather conditions; and thoroughness of application. Deer are less apt to browse on agricultural or forest crops that have been treated with a repellent. However, a lack of normal food may cause deer damage even though a repellent has been applied. Weather conditions affect the length of time a repellent remains effective. During seasons of heavy precipitation, the effectiveness of a repellent will be lessened because of erosion and dilution. The degree of thoroughness used when applying repellents will determine the amount of protection they afford.

Some of the more effect repellents are those containing THIRAM or Z.A.C. It is best to follow the manufacturer's recommendations when mixing and applying repellents.

<u>Winter Application</u>: Applying the repellents to only the terminal growth will provide sufficient protection. This method is more economical than treating the entire tree. All terminal tips should be treated to a height of 6 feet above the expected snowline. (NOTE: The same repellents recommended above, if applied as a drenching spray, will protect fruit trees from rabbit damage.)

FENCING

Another effective means for keeping deer out of orchards is by a deer-proof fence. The degree of damage and size of the area will determine whether fencing is feasible. Although the initial cost of erecting the fence may seem high, when prorated over a period of years it may pay for itself in increased crop yields.

HUNTING

Depending upon state regulations, problem deer can be removed during the regular deer hunting season. Orchardists should show hunters the problem areas that deer are frequenting. This will enhance the hunter's chances and also remove deer that are causing damage.

****

CALCIUM: ITS RELATIONSHIP WITH APPLE QUALITY AND YIELD

William J. Bramlage, Mack Drake and John H. Baker
Department of Plant and Soil Sciences

Last year we reported results of experiments to increase the calcium (Ca) levels of apple trees and fruit, and of determinations of the effects of Ca level in fruit on their keeping quality (Fruit Notes 37 (November-December 1972):4-6). Tests were continued during the 1972-73 season and some interesting relationships were observed.

The 1972 growing season was unusually cool and wet, and the apples produced generally had exceptionally good storage quality. The Baldwin apples in our study were no exception. At commercial harvest, 1-bushel samples of apples were taken from individual trees within a block of 52 mature trees of varying Ca levels. These samples were stored in 32^{o}F air for 5 months, and then kept at room temperature for up to 9 days. The amount of bitter pit, scald, internal breakdown and decay were recorded, 10 fruit per box were pressure-tested, and then fruit from each box were peeled and the peels were analyzed for Ca.

As seen in Table 1, very little bitter pit occurred in 1972, in contrast to 1971 when at least half the fruit were pitted. Furthermore, most of the pit that was found developed on the fruit with extremely low Ca. Internal breakdown, which occurred frequently the previous year, was almost absent in 1972 and is not listed in Table 1. Decay was also much lower than the previous year, yet it can be seen in Table 1 that Ca deficiency can increase the amount of rotting during and after storage. Scald susceptibility was also increased when Ca was low. This was not seen the previous year, perhaps because other disorders were so prevalent that scald could not be easily seen.

Table 1. Relationships between peel Ca content and condition of 'Baldwin' apples after 5 months storage in 32°F air.

Peel Ca (Ca)	Firmness (lbs pressure)	Bitter pit (%)	Scald (%)	Decay (%)
.0450-.0500	13.6	7	32	12
.0501-.0600	13.2	1	28	3
.0601-.0700	12.8	1	37	1
.0701-.0800	11.2	1	16	4
.0801-.0900	11.0	0	10	3
.0901-.1000	11.1	0	9	2
.1000-.1400	11.1	0	8	1

The results of pressure tests were surprising. Low Ca apples were 1.5 to 2.5 lbs firmer than high Ca apples (Table 1). However, this was misleading because the apples were actually mealy. Drs. Miklos Faust and C.B. Shear of the U.S.D.A. at Beltsville, Maryland last year suggested that pressure tests may not be accurate for low Ca apples, and this suggestion appears to be correct. The apparently firmer low-Ca 'Baldwins' were definitely not of superior quality to the high-Ca fruit.

Another aspect of our study was to determine if Ca levels influence the time of fruit ripening. The best way to accurately answer this question is to examine fruit respiration, since it undergoes a distinct rise and fall (the "respiratory climacteric") during ripening. When respiration of apples of varying Ca levels was compared, it was clear that the Ca levels had no significant effect on time of ripening. This was somewhat surprising; the previous year's results showed so much more extensive fruit deterioration with low Ca that we suspected that these apples had ripened earlier. Since ripening rate was not affected by Ca, the deterioration during and after storage attributable to low Ca must have been directly due to more rapid aging of the apples after harvest.

We attempted to predict Ca levels in 1972 from the Ca levels in 1971. This did not work. Trees low in Ca in 1971 were relatively high in 1972, and vice versa. We noticed that low Ca apples were usually larger than high Ca apples, so we examined yield data for 1971 and 1972. In Table 2, it can be seen that crop size had a major effect on fruit Ca level. In both years, the trees with very low Ca were those bearing few fruit, and those with high Ca were those bearing heavy fruit crops. Since these Baldwin trees tend to biennial bearing, the Ca level of individual trees reversed during 1971 and 1972. The low yield, low Ca trees in 1971 became the high yield, high Ca trees of 1972, and vice versa. The effect of crop size on fruit Ca may lie in the vigorous vegetative growth that occurs when crop size is small; available Ca may be directed

into the growing stem tips at the expense of the developing fruit. It seems probable that one way of combatting excessively low Ca in fruit is to maintain annual rather than biennial bearing.

Table 2. Relationship between peel Ca content of Baldwin apples and total fruit yield per tree.

1971		1972	
Range, peel Ca (%)	Avg. yield/tree (bu. boxes)	Range, peel Ca (%)	Avg. yield/tree (bu. boxes)
.0350-.0500	5.6	.0450-.0500	3.4
.0501-.0600	12.1	.0501-.0600	8.1
.0601-.0700	14.1	.0601-.0700	14.5
.0701-.0800	23.4	.0701-.0800	20.5
.0801-.0920	19.2	.0801-.0900	21.9
		.0901-.1080	21.7

Conclusions drawn from the 1972 experiments with Ca are as follows:

1. Calcium levels had no effect on time of fruit ripening.
2. Low Ca in apples led to increased susceptibility to storage disorders and rots.
3. Small crop size decreased the Ca level in the fruit, and large crop size increased fruit Ca.

An additional observation should be noted. In 1971 and 1972, nearly the same range of Ca levels existed among the trees, although the individual trees changed greatly. However, occurrence of disorders and decay was much less than in 1971, even on the very low-Ca fruit. It therefore appears that while low Ca is related to poor "keeping" quality of apples, it is only among several contributing factors. In other words, there is much more to "keeping" quality than just Ca. For example, low fruit Ca makes the fruit susceptible to pitting, but some factors, such as moisture stress or high temperture, "triggers" this disorder. This disorder seldom occurs in high Ca fruit.

****

EFFECT OF TWO APPLE VIRUSES ON RESPIRATION AND ON ORGANIC ACID AND SUGAR COMPOSTION OF APPLE FRUITS

J.S. Makarski and G.N. Agrios
Department of Plant Pathology

Plant viruses are known to reduce the photosynthetic ability of leaves and to at first increase and later decrease the respira-

tion of leaf tissue. Very little is known, however, about the direct or indirect effects of virus infections on fruit. The reduced photosynthetic ability of the leaf might be reflected in the acid and sugar compositions of the fruit, which are important aspects of fruit quality. In addition, the keeping quality of fruit is influenced greatly by its respiration rate and if viruses increase the respiration rate, they might shorten the storage life. Furthermore, the general pattern in many virus diseases appears to resemble an accelerated aging process. Apple trees are subject to virus infections, and we have conducted a two-year study to determine the effect of virus infections on the onset and intensity of the respiratory climacteric, i.e. the rise and fall of respiration that occurs during apple ripening, and the effect on sugar and acid composition of the fruit. For this study, we used McIntosh apple trees growing in a commercial orchard that we knew were infected with either apple mosaic virus, which causes foliar symptoms but not fruit symptoms, or with russet ring virus, which causes both foliar and fruit symptoms. We compared apples from these trees with fruit from other trees in the same orchard that showed no signs of virus infection. Respiration was measured on samples taken in June, July and August, as well as on samples collected in September. Sugars and acids were also measured on these samples, using various chemical procedures.

Results of this study showed that neither apple mosaic virus nor russet ring virus affected the respiration rate of the apples. The amount of O_2 used by the fruit, the amount of CO_2 they produced and the "respiratory quotient" (the ratio of these two values) were about the same whether or not the apples were from virus-infected trees. In addition, the respiratory climacteric occurred at just about the same time in all the fruits, indicating that time of ripening was not affected by the virus. The virus-infected fruit did appear to respire more rapidly than the healthy apples during the climacteric, but we do not know the significance of this difference.

The chemical analyses of the apples showed only two acids in measurable amounts--quinic acid and malic acid. The amount of quinic acid was not affected by either virus. However, both viruses slightly reduced the amount of malic acid in the apples. Virus infection of trees did not result in any consistent major difference in the relative concentrations of the three main sugars (glucose, fructose, and sucrose) in fruit during either of the two years.

We concluded from this study that neither apple mosaic virus nor russet ring virus had much effect on the behavior or quality of McIntosh apples. This is rather surprising since viruses affect both the behavior and chemical composition of leaves. However, we have no information about the concentrations of apple mosaic or russet ring viruses in fruit tissues, and in fact only RRV exhibits fruit symptoms. If virus is present and operates only in the area where symptoms appear on the fruit, its effects might not be measur-

able when whole apples are examined, since most of the cells would therefore be healthy. Nevertheless, from a practical viewpoint, it appears that even when these viruses are known to exist in an orchard, fruit quality can be expected to be similar whether or not they come from affected trees. However, it must be emphasized that yield may be drastically reduced by these viruses. Yield reductions of from 12% to 55% on trees affected with apple mosaic virus have been measured. Therefore, growers should certainly not conclude from this study that viruses are not important concerns. They are causes for a great deal of concern!

****

FRUIT NOTES INDEX FOR 1973

(This index of major articles has been prepared for those who keep a file of <u>Fruit Notes</u>. The number in parentheses indicate the pages on which the item appears.)

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 39 (No. 1)

JANUARY–FEBRUARY, 1974

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

PROGRESS IN BREEDING HARDY ROOTSTOCKS AND HARDY PEACHES FOR THE FRESH MARKET AT HARROW

R.E.C. Layne, Research Scientist (Pomology)
Research Station, Canada Agriculture, Harrow, Ontario

The main objectives of the peach rootstock improvement program at Harrow are to develop seedling rootstocks that have cold-hardiness combined with good adaptation to light, sandy soils. Other important attributes include: nematode and disease resistance, size control, scion compatibility, seed productivity, ease of germination, nursery uniformity and ease of budding. Appropriate laboratory, greenhouse, nursery and field tests are conducted to provide strong selection pressure for these characters.

If some peach rootstocks were able to impart certain desirable characteristics to scion varieties, such as size control, precocity, or cold-hardiness, then the choice of rootstocks could become almost as important as the choice of the scion varieties themselves. Most published evidence tends to discount this possibility. However, during the last four years, we have obtained a significant body of data at Harrow which prove conclusively that at least one peach seedling rootstock 'Siberian-C', in addition to having very cold hardy roots, also imparts the following characteristics to the scion variety: 1) greater cold hardiness, 2) earlier defoliation, 3) earlier bearing, 4) greater production in the early years, 5) earlier ripening, and 6) slight to moderate dwarfing. These are important effects that have great commercial significance. To date, no compatibility problems have been encountered with 'Siberian-C.'

This rootstock was released by the Harrow Research Station in 1967. The mother trees are virus free and the seed stocks are virus free as well. Several seed orchards have been established in Canada and the United States which should provide an adequate seed supply to the peach industry in both countries in a few years. It should be noted, however, that 'Siberian-C' is not resistant to root knot or root lesion nematodes.

We also released another rootstock in 1967, 'Harrow Blood', on account of its cold-hardiness and possible size controlling ability. Further tests have shown that although 'Harrow Blood' is more cold-hardy than 'Halford', 'Elberta' or 'Rutgers Red Leaf', it is less cold-hardy than 'Siberian-C.' Trees on 'Harrow Blood' tend to be smaller than standard when young but the dwarfing response tends to disappear as the trees attain bearing age. The beneficial effects of 'Siberian-C' on scion varieties previously mentioned have not been noted with 'Harrow Blood.' It appears, therefore, that 'Harrow Blood' should not be used if 'Siberian-C' is available. 'Harrow Blood' is also more difficult to handle in the nursery than other commonly used peach seedling rootstocks.

Our efforts in rootstock breeding are now aimed at developing cultivars with the cold-hardiness of 'Siberian-C', and the red foliage of 'Rutgers Red Leaf', combined with nematode, crown gall and canker resistance, and greater tolerance to finer textured soils that are not as well drained. This work is just under way and will require many years of selection and testing to develop improved varieties.

We also have a major peach breeding program to develop cold-hardy, attractive, disease resistant freestone cultivars with high quality suitable for the fresh market and also suitable for canning and freezing. In 1968, we released 'Harbelle' and 'Canadian Harmony.' They were followed by 'Harbrite' in 1969, 'Harken' in 1970 and 'Harbinger' in 1971. We are receiving many encouraging reports on the performance of these new varieties in Canada and the United States. We also have several promising numbered selections which require further testing before a decision can be made on their naming and introduction. They are presently being tested by research cooperators at other Experiment Stations in Canada and the United States and by cooperating growers in both countries. A summary of their main features is given in Table 1.

The testing of numbered selections from our program is conducted by the Western Ontario Fruit Testing Association. This organization has contracted with Hilltop Orchards and Nurseries Inc., Hartford, Michigan, to make these selections available in limited quantities and under restricted propagation to interested growers in the United States. They are available for test with the understanding that they are not yet proven and may not warrant commercial introduction. Nevertheless, they have been selected for cold-hardiness, tolerance to bacterial spot, eye appeal and quality and appear to be worthy of further test. Recently, we have selected two promising cold-hardy nectarines, HW101 and HW102, that ripen 3 to 7 days, respectively, after 'Redhaven.' Trees of these will be available for test in 1974 and 1975.

You should heed the advice of your Pomologists and Extension Horticulturists before making too large a commitment to our new varieties and numbered test selections because other varieties may be better suited to your climate and the needs of your industry. Limited quantities of the numbered selections are available for test from Hilltop Orchards and Nurseries Inc., Hartford, Michigan, and from the Western Ontario Fruit Testing Association, Harrow, Ontario. The named varieties are available from the major nurseries in the United States and Canada.

Table 1. Summary of main features of Harrow peach varieties and promising test selections evaluated at the Harrow Research Station compared with 'Redhaven'

A Name or number	B Ripe date	C Productivity	D Diam. (in.)	E Red color (%)	F Flesh firmness	G Quality	H Pit freeness	I Ripening uniformity	J Hardiness	K Use
Harbinger	7/19	4	2-1/4	80	3	3	1	4	4	F
HW201	7/27	4	2-1/2	70	3	2	2	3	4	F
H719	7/31	2	2-1/2	80	3	3	3	4	2	F
Harbelle	8/4	3	2-3/4	60	3	3	3	3	4	F
H1102B	8/12	3	2-1/2	70	4	4	4	4	2	F+P
HW207	8/12	3	2-1/2	70	4	4	4	4	4	F+P
Redhaven	8/15	4	2-1/2	70	4	4	4	2	4	F+P
Harken	8/17	3	2-1/2	80	4	5	4	4	4	F+P
Harbrite	8/19	5	2-1/2	80	4	4	4	3	4	F+P
H593	8/20	4	2-3/4	50	3	4	4	5	4	F+P
HW101	8/20	4	2-1/2	90	3	4	4	4	4	F
H4219	8/22	4	2-1/2	70	4	4	4	3	4	F+P
HW102	8/23	4	2-1/4	90	3	3	4	3	5	F
H2091	8/25	3	2-3/4	70	3	4	4	3	4	F+P
Canadian Harmony	8/27	4	2-3/4	80	4	4	4	3	3	F+P
HW204	9/4	4	2-1/2	50	5	3	4	3	4	F+P
H2219	9/6	3	2-1/2	70	5	5	5	4	3	F

A HW101 and HW102 are nectarines
B First date at which a few soft ripe fruit can be picked
C 1 = very light to 5 = very heavy
D Average fruit diameter
E Percent of skin surface that is red in color
F 1 = very soft to 5 = very firm but melting flesh
G 1 = poor to 5 = outstanding
H 1 = cling to 5 = air free
I 1 = poor to 5 = very good
J 1 = tender (Redglobe) 2 = medium tender (Loring) 3 = medium (Elberta)
4 = medium hardy (Redhaven) 5 = hardy (Reliance
K F = for fresh use only, F+P = for fresh use, home canning and freezing.

****

VARIETIES OF BLUEBERRIES FOR MASSACHUSETTS

James F. Anderson
Department of Plant and Soil Sciences

Variety*	Recommended for	Harvesting Season
Earliblue	C & H	Early
Bluetta	T	Early
Collins	C & H	Early
Blueray	C & H	Early
Bluecrop	C & H	Midseason
Berkeley	C & H	Midseason
Herbert	C & H	Late
Jersey	C & H	Late
Rubel	H	Late
Coville	C & H	Late

*In approximate order of ripening

T = Trial H = Home garden
C = Commercial - Varieties so marked are not necessarily adapted to all parts of the state.

Earliblue — Ripens early, fruit light blue, very firm, good flavor, cluster medium size, medium loose. Bush upright, vigorous, well-shaped, easy to prune and propagate. Requires a high concentration of bees for adequate pollination and fruit set. Especially attractive to birds.

Bluetta — Ripens with or slightly after Earliblue. The plants are short, compact spreading and medium in vigor. The fruit is medium-sized of good flavor, light blue in color, firm and has a broad stem scar. The clusters are loose.

Collins — Ripens early, midway between Earliblue and Bluecrop. The bush is erect, vigorous, and moderately productive. May winter kill in cold winters or cold locations. The fruit is borne in medium-sized, rather tight, attractive clusters. The berries are as large as Earliblue, firm, light blue in color and highly flavored. Fruit does not drop nor crack. Collins requires a high bee population for adequate pollination and fruit set.

Blueray — Ripens early, just after Earliblue; fruit clusters small, tight attractive; berries very large, firm, light blue, aromatic, very fine flavored if fully ripe; bushes erect, somewhat spreading, vigorous and productive. Has considerable cold resistance. Easy to prune.

Bluecrop	Ripens early mid-season, fruit very light blue, very firm, good flavor, small scar, clusters large, medium loose. Bush upright, vigorous and productive, easy to propagate, easy to prune, resistant to spring frost and winter cold.
Berkeley	Ripens mid-season, fruit very large, light blue, firm, mild flavor, scar large and dry; bush upright, vigorous, productive, easy to propagate and prune.
Herbert	Ripens late, fruit large, fair blue, good scar, flavor good, skin tender; bush spreading, vigorous, productive and easy to propagate. Superior for local market and home use.
Jersey	Ripens late, fruit medium to large, fair blue, attractive, firm, good flavor, but tart if not fully ripe, good scar, open cluster; bush upright, vigorous, productive, hardy.
Rubel	Ripens late, fruit medium size, firm, good flavor, good blue, fairly attractive, good scar; bush upright, very vigorous, very productive, hardy. Rubel is recommended for those persons desiring a smaller highly flavored berry for muffins and pancakes.
Coville	Ripens very late, fruit large, firm, good scar, highly aromatic flavor, tart when not fully ripe, good blue, attractive; bush upright, spreading, vigorous and very productive. Coville requires a high bee concentration for adequate pollination and fruit set.

****

PUBLICATIONS AVAILABLE

Available from Washington State University, Pullman, Washington, is Extension Bulleting 634 entitled "Frost and Frost Control in Washington Orchards." This publication discusses the factors affecting frosts and freezes, weather monitoring equipment, and frost prevention techniques. Of particular interest are tables showing the critical temperatures for blossom buds for several fruits, including apples, pears and peaches.

Available from the Cooperative Extension Service, University of Rhode Island, Kingston, Rhode Island, is Bulletin 143, entitled "Highbush Blueberry Culture." This publication discusses all phases of blueberry production including propagation.

****

PERFORMANCE AND ANCHORAGE OF ROOTSTOCK-SCION COMBINATIONS UNDER HIGH MOISTURE CONDITIONS

Duane Greene
Department of Plant and Soil Sciences

Research results and grower observations are continually reconfirming reports that apple trees grown on size-controlling rootstocks are more productive, precocious and efficient. However, much information is still needed so that fruit growers can improve production by more intelligent choice of rootstocks for future plantings.

In 1964 and 1965, a rootstock trial involving six rootstocks and five varieties replicated eight times was initiated at the Horticultural Research Center in Belchertown, Massachusetts. Rootstock and scion selections were made to include those that, at the time, appeared to hold the most promise for fruit growers in New England. All rootstock-scion combinations grew well for the first six years. During the first four growing seasons of the 1970's, above average rainfall was experienced that resulted in waterlogged soil conditions for much of the year. In addition, high winds from tropical storms in August of 1970 and 1971 blew over a considerable number of the trees in this experimental planting. Although the damage invalidated much of the data for which the trial was established, it did provide an excellent opportunity to compare the anchorage and to qualitatively evaluate the performance of the rootstock-scion combinations under high moisture conditions .

Table 1 shows the percent trees of each rootstock scion combination that were blown over during these two storms. These data confirm earlier reports that trees grown on M 7 were poorly anchored particularly when Red Delicious was the scion variety. All eight trees were uprooted by the wind. The Niagara/M 7 combination was also poorly anchored. The only other combination that appeared to be poorly supported was Red Delicious/M 2, where 57% of the trees were tipped over by the wind. To the contrary, all varieties on MM 106 and seedling roots remained well anchored.

Table 1. Effect of Rootstock-Scion Combination on the Anchorage of Trees Grown at the Horticultural Research Center, Belchertown, Massachusetts.

Scion	Rootstock - % trees tipped over					
Variety	M 2	Robusta 5	M 7	MM 106	MM 104	Seedling
Puritan	0	0	0	0	0	0
Niagara	0	0	63	0	0	0
McIntosh	0	17[a]	13	0	0	0
Delicious	57[b]	14[b]	100	0	13	0
Golden Delicious	0	0	13	0	13	0

[a]Replicated 6 times
[b]Replicated 7 times

If you intend to plant one of these rootstock-scion combinations that has been shown to be poorly anchored, several suggestions may be made.

1. Purchase trees that have been budded at least 18 inches high.

2. Avoid planting trees on soil types not favorable for deep rooting.

3. Avoid planting trees on windy sites.

4. Provide support for newly planted trees to minimize whipping of the tree and thus encourage adventitious root formation along the entire below-ground portion of the rootstock.

Of the six rootstocks included in this experiment, MM 104 appeared the least tolerant to the wet conditions of the last 4 years. This agrees with reports of others who have found that MM 104 rootstock does not perform well on poorly drained sites. However, the differences in leaf color, terminal growth and fruit size between trees on MM 104 and the other rootstocks was not great. The other rootstocks in this trial (MM 106, M 7, Robusta 5, Seedling, M 2) are considered intermediate in their tolerance to high moisture conditions. Differences among these intermediately tolerant stocks were not observed. Yellowing of the leaves and reduced terminal growth were noted to a limited extent on all rootstocks indicating that all rootstocks in this test were injured by the excessive moisture conditions.

Planting trees on poorly drained sites is hazardous at best and is not recommended. However, if a grower wishes to take the chance and plant on a poorly drained site, one suggestion may be made. Plant trees that have been budded on M 13 rootstock. This rootstock has been shown to be somewhat tolerant to wet soil conditions, but it should be noted that scion varieties budded on this rootstock grow to a size similar to those budded on seedling roots.

****

HAY MULCH MAY BE A VALUABLE SUPPLEMENT TO A HERBICIDE PROGRAM IN ORCHARDS

William J. Lord
Department of Plant and Soil Sciences

Several years ago, we showed that simazine, a pre-emergence herbicide, accumulated in the hay mulch under apple trees. As a

consequence, the residue in the soil under the mulch was less than when simazine was applied on sod or cultivated soil. The question arose whether this accumulation in mulch was of practical significance. To answer this question, in 1968, we initiated an experiment in a block of Richhaven peach trees at the Horticultural Research Center using dichlobenil (Casoron*) as the pre-emergence herbicide.

TREATMENTS

The trees were planted in the spring of 1968 and 4 bales of hay weighing approximately 40 lbs each were spread over a circular area extending 7 feet from the tree trunk. (A grower would probably apply only 1 bale to a limited area. The amount applied in the experiment was approximately equivalent to one bale on a circular area extending 3-1/2 feet from the trunk.) Eight single-tree replications of the following treatments were established in November, 1968: (A) hay mulch applied only at planting; (B) cultivation twice annually in May and early July; (C) dichlobenil at 6 lbs of active ingredient per acre (ai/A) applied annually; (D) dichlobenil at 12 lbs ai/A applied annually; (E) dichlobenil applied on mulch at 6 lbs of ai/A; and (F) dichlobenil applied on mulch at 12 lbs of ai/A annually. The mulch was removed prior to establishing treatments B, C, and D.

RESULTS

Leaf injury. Foliar injury symptoms, characterized by leaf margin yellowing (LMY) and leaf tip burn resulted from treatments with dichlobenil (Table 1).

Table 1. Percent of leaves on terminal shoots of Richhaven peach trees showing leaf injury following dichlobenil usage.

Treatment[z]	% leaves showing injury in late Aug.[y]				
	1969	1970	1971	1972	1973
On bare soil, 6 lbs dichlobenil	30b[x]	69b	78a	15bc	50b
On mulch, 6 lbs dichlobenil	0c	18c	47b	8c	30b
On bare soil, 12 lbs dichlobenil	69a	94a	94a	70a	97a
On mulch, 12 lbs dichlobenil	0c	53b	81a	29b	91a

[z]Dichlobenil applied annually in mid-November for 5 consecutive years starting in 1968.

[y]Three shoots per tree.

[x]Mean separation, within columns, by Duncan's multiple range test at the 5% level.

The mulch application in May, 1968, prevented foliar injury in 1969, even though one dichlobenil treatment was twice the recom-

mended rate (12 lbs). The mulch decomposed rapidly and was less effective in 1970 through 1972. In 1972, LMY appeared later and was less severe than in 1971. Total rainfall from April through June, 1972, was 148% of the 1967-71 average for these months and the temperatures were lower than normal. These weather conditions could have been responsible for the reduction of foliar injury from dichlobenil in 1972 in comparison to previous years; the effect would most likely be due to temperature, since dichlobenil does not leach readily. In 1973, foliar injury from dichlobenil was again severe and mulch did not reduce severity.

Weed control. The data in Table 2 show that the single application of mulch in 1968 was of little or no value for weed control and this was mainly due to reinfestation by quackgrass.

Table 2. Effects of soil management practices on weed control under Richhaven peach trees planted in 1968.

Treatment	Weed control in mid-August (%)				
	1969	1970	1971	1972	1973
Cultivation	95a^z	56c	45d	7c	2c
Dichlobenil, 6 lbs	44c	54c	50cd	9c	3c
Dichlobenil, 12 lbs	83b	81a	77b	29b	8bc
Mulch	16d	7d	3e	--^{y}	--^{y}
Mulch + dichlobenil, 6 lbs	53c	68b	61c	9c	13b
Mulch + dichlobenil, 12 lbs	91ab	90a	94a	60a	44a

^{z}Mean separation, within columns, by Duncan's multiple range test at the 5% level.

^{y}Since the effectiveness of mulch for control of weeds had disappeared the data were not included in the statistical analysis.

Several annual grassy weeds and quackgrass invaded the cultivated and herbicide treated areas particularly in 1972 and 1973. During these 2 years, only 12 lbs dichlobenil applied on top of the mulch residue resulted in an appreciable control of these annual weeds.

Tree performance. Due to the severity of leaf injury symptoms, one would expect reductions in growth and productivity of the trees. For the first 3 years of the experiment, there was no growth or yield difference among treatments with the exception of the mulch treatment. The mulched trees produced significantly less vegetative growth in 1970 and 1971 and had the least yield in 1971.

Limb breakage and the presence of weak limbs invalidated the growth and yield data after the 1971 growing season. This is indeed unfortunate, since leaves on the trees receiving either 6 or 12 lbs dichlobenil on bare soil had interveinal chlorosis and brown, tattered leaf margins. Some of the more severely injured leaves dropped in early September. Therefore, it is unfortunate

that reliable growth and yield data could not be obtained in 1972 and 1973 and the experiment continued for another 2 or 3 years.

DISCUSSION

Younger fruit trees are less tolerant of herbicides than older trees. The tolerance difference probably is due to the limited root system and "depth protection" of newly-set trees. The results from the present experiment show that hay mulch can be of value for reducing the risk of injury to young trees from pre-emergence herbicides (Table 1). Hay mulch decomposes rapidly, however, and additional applications seem necessary to sustain this beneficial effect.

Better weed control in 1972 and 1973, resulting from 12 lbs of dichlobenil applied on the mulch residue rather than on bare soil (Table 2), shows another possible benefit of mulch. Dichlobenil content was higher in the mulch (7 ppm as compared to 0.5 ppm in the top 0.6 inches of the unmulched soil) and was probably responsible for killing many germinating annual weeds.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

—

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S.MAIL

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol.
Vol. 39 (No. 2)
MARCH – APRIL 1974

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

CHEMICAL FROST PROTECTION FOR FRUIT BLOSSOMS

B.R. Boyce
Department of Plant and Soil Science
University of Vermont

Frost injury on fruit blossoms amounts to millions of dollars worth of crop losses annually. Methods of reducing these losses fall into four general categories: 1) variety selection; 2) site selection; 3) adding heat during a frost; and 4) reducing heat loss during a frost. A fifth method would be through the application of substances to lower the killing temperature of the blossoms. Several chemicals are currently being tested for this purpose. One of these materials is Chem-Frost*, a commercial product marketed by Chemical Frost Control Corporation of Meridian, Idaho.

Chem-Frost* was sprayed at a dilution of 1 to 100 on Catskill strawberry plants under both greenhouse and field conditions and on McIntosh apple, Delicious apple and Bartlett pear trees in the field. Three applications were applied to the point of run-off. The first application went on the strawberries as growth started but before flower buds were visible, the second application as the buds were first noticeable, and the third just prior to the first bud opening. The first application on the apples and pears occurred at silver tip, the second at green tip, and the third at half-inch green.

Blossoms were collected at full bloom from the treated plants and from untreated checks and frozen at several temperatures. After two hours at each temperature they were floated on water for 24 hours and evaluated for injury.

Table 1 summarizes the number of blossoms killed at each temperature. The temperatures ranged from 31°F, which did not kill any blossoms to 23°F which killed all blossoms. Under the conditions of this experiment, Chem-Frost* did not significantly reduce the amount of low temperature injury to the blossoms of any of the fruits tested at any of the temperatures used. In some cases, in fact, there appeared to be a trend towards more injury where the material was used than on the unsprayed checks.

The manufacturer of Chem-Frost* is now marketing a new formulation of the frost-protection agent. We have not tested the new formulation. However, the results of our tests showed that under the old formulation, Chem-Frost* applied under Vermont conditions had no effect on lowering the killing temperature of strawberry, apple, or pear blossoms.

---

*Trade name

Table 1. Effect of Chem-Frost* on number of blossoms killed after exposure to several freezing temperatures, 1972.

	Number of blossoms killed at various temperatures (°F) 31	29	27	25	23	Total Killed	% Killed
Greenhouse Strawberries							
Check	0	2	8	27	40	77	38
Chem-Frost*	0	2	10	33	40	85	42
Field Strawberries							
Check	0	8	10	26	40	84	42
Chem-Frost*	0	10	27	28	40	105	52
McIntosh Apples							
Check	0	2	4	8	20	34	34
Chem-Frost*	0	4	7	10	20	41	41
Delicious Apples							
Check	0	2	5	14	20	41	41
Chem-Frost*	0	0	6	19	20	45	45
Bartlett Pears							
Check	0	1	4	10	20	35	35
Chem-Frost*	0	0	4	9	20	33	33

*Trade name

****

SUGGESTIONS FOR FERTILIZATION OF PEACH TREES IN 1974

William J. Lord
Department of Plant and Soil Sciences

Tree growth is the best guide to how your fertilizer program fulfills the needs of peach trees, if soil moisture is not a limiting factor. Since fruit buds of the peach are formed along the new shoot growth, it is essential to produce adequate new growth annually by the use of a nitrogen (N) fertilizer. Young peach trees should make about 18 inches of new terminal growth annually; 12-15 inches are sufficient for mature trees. Growth in excess of these amounts may result in poor fruit color and excessive cold injury. The kind of N to use should be chosen on the basis of cost of actual N and/or availability of fertilizers. Ammonium nitrate or a "complete fertilizer" has been most commonly used in the past to supply N needs.

Potassium (K) is the only nutrient, other than N, that is frequently deficient in Massachusetts peach orchards. Therefore, the recommendations given below are guides for fulfilling the N and K needs for peach trees. The K may be applied either in the spring

or fall, but N fertilizer should be applied in the spring about 2 or 3 weeks before bloom.

Suggested Rates of Fertilizer for Bearing Peach Trees

	Approximate amounts per tree (lbs)	
Tree age	Ammonium nitrate or its equivalent	Muriate of potash or its equivalent
3 - 6	1/2 - 1	1 - 2
6 - 9	1 - 1-1/2	2 - 3
9 - 12	1-1/2 - 2	3 - 4
12 and over	2 - 4	4 - 8

****

RESEARCH FROM OTHER AREAS

Mack Drake
Department of Plant and Soil Sciences

Calcium distribution in 'Merton' apple fruits. A paper entitled "Longitudinal Distribution of Applied Calcium and of Naturally Occurring Calcium, Magnesium, and Potassium in 'Merton' Apple Fruits," which appeared in the Australia Journal of Agricultural Research, Volume 24, 1973, by T.L. Lewis and D. Martin, contains several pertinent findings concerning calcium (Ca) in apple fruit.

These workers showed that the Ca concentration in the 'Merton' fruits declined from the stem end to the calyx end, which may explain why bitter pit lesions generally are more prevalent near the blossom end of apples. On the other hand, Mg concentration increased toward the calyx end to about 8 times the Ca concentration. The authors proposed that if the Ca level in the calyx end of fruits were to fall below the critical level, the concentration of Mg would be high enough to replace Ca within the cells of the apples.

This replacement may have adverse effects on the cells and cause bitter pit lesions to develop. This emphasizes the importance of maintaining other nutrients in balance with Ca.

To find out why Ca sprays are more effective than soil applications in increasing fruit Ca, Lewis and Martin injected radioactively labeled calcium chloride solution into a fruiting branch of a 'Merton' tree 8 weeks prior to harvest. Only very small amounts reached the calyx end of the mature fruits. Leaves and buds on the injected branch accumulated 95% of the recoverable Ca, and the fruits accumulated the remaining 5% of which only about 1% was in the calyx end. This illustrates why it is difficult to in-

crease Ca in fruit by soil applications of this element. Not only is there very poor absorption of Ca into apple trees, but also what does enter moves slowly and much of it is immobilized in plant tissue other than fruit.

Radio-actively labeled calcium chloride was then applied to the skin of 'Merton'apples at several stages of development. Applying Ca to more developed rather than to very young fruits increased the amount of Ca absorbed, so that mid- to late- summer sprays should be more effective than early-summer sprays in controlling bitter pit.. In addition, they found that more Ca was absorbed into the calyx end than into the stem end region of a fruit, regardless of its age. Therefore, the greatest absorption was into that portion of the fruit that is lowest in Ca and most subject to bitter pit. The authors stated that the lenticels (dots) on apples are an entry sitefor Ca sprays and that lenticels are more numerous on the calyx end than on the stem end of an apple. With more entry points at the calyx end, direct application of Ca should be (and is known to be) the most efficient way of increasing fruit Ca and reducing bitter pit.

In summary, the research by Lewis and Martin shows why tree sprays may be more effective than soil applications for increasing Ca content of apple fruits. Growers with bitter pit or cork spot problems in their orchards may wish to use the control measure for these disorders suggested in the article enclosed in this issue of Fruit Notes entitled "Suggestions for Fertilization of Apple Trees in 1974."

****

SUGGESTIONS FOR FERTILIZATION OF APPLE TREES IN 1974

William J. Lord
Department of Plant and Soil Sciences

Most apple orchards appear to have an abundance of fruit buds which, with favorable weather, could produce an excessive crop in 1974. Therefore, your fertilizer program in 1974 should be directed toward the production of a medium-sized crop of high quality fruit.

Nitrogen (N): To help accomplish the above goal, we believe that N applications should be reduced by one-third to one-half in many bearing blocks. Most McIntosh trees had only a light crop in 1973 and these should have considerable reserve N available for utilization this spring. Blocks of excessively vigorous trees probably should receive no N. It is well to remember that it may take several years before an appreciable decrease in N level occurs on excessively vigorous trees.

Reduce or omit N on young, vigorous McIntosh trees if they are starting to bear a crop, in order to avoid excessively large, poorly colored fruit. Young vigorous, non-bearing McIntosh apple trees may have N levels of 2.4-2.6%, but these N levels should be reduced when trees start to produce.

Apply sufficient N to keep bearing Delicious trees vigorous. N levels of 2.2-2.4% in bearing Delicious trees are probably satisfactory because it is necessary to keep the tree vigorous in order to produce large-sized fruits. Furthermore, obtaining sufficient red color on the newer strains of Delicious is not a problem.

The N requirement can be met by applying calcium nitrate, ammonium nitrate or urea sources of fertilizer N or a "complete" fertilizer. (Growers concerned about bitter pit and/or cork spot may wish to rely on calcium nitrate as the source of N.) However, the phosphorous (P) in the complete fertilizer is not needed in our orchards and fertilizer is in short supply. Therefore, we strongly urge growers to purchase a prepared mix such as 15-0-14 which contains no P or to purchase an N and a K fertilizer and mix them prior to application, or apply them separately.

Potassium (K): Results of the leaf analyses for the 1973 season indicated that K levels were generally low in our apple trees. The K requirements of apple trees in a heavy crop year are high since the fruit utilizes about 3 times as much K as N. Secondly, the quantity of K stored by the tree which is available for utilization is extremely small in comparison with N. Thus, it seems important to supply adequate K this spring in anticipation of a heavy crop year. The requirements of apple trees for K (expressed as K_2O) based on potential yields are as follows: (a) less than 15 bu: 1.3 lbs/tree; (b) 15 to 25 lbs: 1.3-2.7 lbs/tree; and (c) more than 25 bu: 2.7-4.3 lbs/tree. It is necessary, however, to maintain a balance among the essential nutrients for apple trees. Excessive levels of K can reduce both leaf and fruit Ca. Therefore, you should attempt to maintain K levels in apple leaves in the range of 1.25 to 1.60%.

Calcium (Ca): As expected, Ca in our apple leaves in 1973 continued to be considerably less than the supposedly desirable content of 1.25-1.50%. Bitter pit was more prevalent than usual on McIntosh apples during 1973-74 harvest and storage season mainly due to large fruits and a light crop. As pointed out in the article included in this issue of Fruit Notes entitled "Calcium Distribution in 'Merton' Apple Fruits," it is very difficult to increase Ca content of apple trees and fruits particularly from soil applications of Ca. Nevertheless, we suggest that when you apply lime, you use a high Ca lime, such as Cal-Mag*, rather than using one high in Mg. The use of foliar sprays of Ca solutions continues to be the most satisfactory means of reducing bitter pit or cork spot. A few growers have used calcium chloride sprays the last 2 years with no or minimal leaf injury from the sprays. However, we still suggest trial

*Trade name

use of this compound until more information can be obtained concerning safeness of calcium chloride from the standpoint of leaf injury. Apply the calcium chloride sprays as separate applications. Use 2 lbs of calcium chloride per 100 gallons of water beginning 2 weeks after petal fall, because research indicates that cork spot deformations arise in the first 30 days of fruit development. Repeat the calcium chloride sprays at 2 or 3 week intervals, totaling 3-5 applications. Where bitter pit is the only problem, the first application can be delayed until July.

Until more experience is obtained concerning calcium chloride sprays, we will continue to suggest calcium nitrate. The timing of the sprays is the same as for calcium chloride. Calcium nitrate (fertilizer of technical grade) is used at the rate of 5 lbs per 100 gallons of water. A spreading agent, such as Triton B, should be added to the calcium nitrate spray at the rate of 3 fluid ounces per 100 gallons of water.

Magnesium (Mg): Most leaf samples had sufficient Mg (0.25% or higher) in 1973. The Mg requirements of trees can best be met by maintaining an adequate dolomitic liming program. Since it takes several years before lime is effective in correcting Mg deficiency, Epsom salt sprays can be used to help correct the condition. Apply 2 or 3 sprays at the rate of 15-20 lbs per 100 gallons of water at the time of calyx, first cover and second cover sprays. To avoid possible incompatibilities, the Epsom salt sprays should not be combined with the regular pesticide sprays. Don't apply Epsom salts or a lime high in Mg unless leaf samples or visual observation indicate need because Mg can suppress Ca.

Boron (B): B was generally low in the leaf samples obtained in 1973. B can be supplied to apple trees either by foliar or soil applications. Use the most economical and convenient method.

Soil applications of B should be applied to orchards every 3 years. Borax is the common material used. The rates of application per tree vary with age and size. Apply 0.25 lb of fertilizer borate (20.2% B) or its equivalent to young trees, 0.5-0.75 lb to medium age and size trees, and 0.75 - 1.0 lb to large or mature trees. If the soil application of B is followed by a wet spring and summer, it may be advisable to apply 2 foliar applications of B the following year.

Many growers rely on annual foliar applications of B. The usual practice is to add Solubor* to the first 2 cover sprays. Fertilizer grades of borax may contain grit and should not be used in a sprayer. Mature trees should receive 4 lbs of Solubor* per acre each year. Consequently, the goal is to apply about 2 lbs per acre in each of the 2 applications. For young orchards, the addition of 0.5 lb of Solubor* per 100 gallons (dilute basis) to the first 2 cover sprays meets the B requirement of these trees.

*Trade name

Reports from New York State indicate that sprays can be concentrated up to 8X with satisfactory results.

Zinc (Zn): Based on optimum levels of Zn established by some states, some of our apple orchards are low in this element. We are not convinced that dormant applications of zinc sulfate are worthwhile from the standpoint of increasing tree performance. Until the value of this zinc sulfate spray applied at the "greentip" stage of bud development can be substantiated, we suggest its use only on a trial basis.

****

DO YOUR BLUEBERRY PLANTS HAVE TIRED BLOOD (DO THEY NEED IRON)?

Dominic A. Marini
Regional Fruit & Vegetable Specialist

In Massachusetts, "iron deficiency anemia" can be a problem to the grower of cultivated blueberries.

Blueberries grow best in an acid soil with a pH between 4.0 and 5.0. One reason for this is that blueberries need iron and iron becomes increasingly available as soil acidity increases. Conversely, at high pH levels, iron is less available and blueberries frequently develop iron deficiency symptoms, however, the recent experience of a Plymouth County blueberry grower shows that iron may be needed even though the soil is acid.

In late summer, 1972, the grower reported that some bushes in one portion of his plantation were not growing well. They were unproductive, the plants produced little new growth, and the new leaves were stunted. Some of the leaves were pale in color, but did not have interveinal chlorosis, the typical symptom of iron deficient blueberry plants. A soil test revealed no difference in nutrient levels between the vigorous and non-vigorous bushes. There was little difference in soil acidity between the productive and unproductive areas; the weak bushes had a soil pH of 4.9, while the vigorous ones had a pH of 5.1. Nevertheless, it was decided to try some fertilizer treatments in the spring of 1973 to see if the cause of the problem could be determined.

The treatments were made on May 3. Three different materials were used, each being applied to the soil around three different bushes. Ammonium sulfate was applied at 1/2 pound, magnesium sulfate (Epsom salts) at 1/4 pound and chelated iron at 1/4 pound per bush.

By September, the answer to the problem was obvious. The bushes treated with iron had dark green foliage and had made good growth. The bushes treated with the other materials made only limited growth, had small leaves, and had now developed the typical interveinal chlorosis symptom of iron deficiency.

If your blueberry bushes are not producing well, making little new growth, and have pale, yellowish leaves, they could be suffering from "iron deficiency anemia."

****

MISNAMED TREES AND PROPAGATION OF THE UNKNOWN

James F. Anderson
Department of Plant and Soil Sciences

As reported in the January-February, 1972 issue of Fruit Notes, one of the major problems encountered in our variety evaluation program is that of misnamed trees. The problem is most acute in our peach testing program, where we have had instances when up to 25% of the trees of one variety were not true-to-name; in other instances, we have had a complete substitution for the variety. We have also discovered mixtures in our apple blocks. One of the most serious problems is in our Red Delicious strain test orchard, where a complete substitution for one strain, and substitutions of one or two trees in two other strains have been found. This could lead to an inaccurate evaluation of a variety or strain. I am sure that this problem can occur in commercial orchards.

Mixtures can develop during several stages of the nursery operation and during the planting operation in the growers' orchards. Many of the major nurseries have their trees inspected for trueness-to-name and this eliminates most of the mixtures that have occurred as a result of budding and/or staking errors. Unfortunately, the budsport strains of apple varieties are indistinguishable from their parent variety and other strains in the nursery row.

Mixtures that occur during the digging and shipping process or when the trees are planted in the grower's orchard will probably not be noticed until the trees have begun to fruit.

It is not uncommon for a grower to forget or lose the variety names of some trees in his orchards. These trees may have proven to be very profitable and he wishes to plant more of them. In such an instance, we would suggest the grower make arrangements with a nursery to custom-bud the number of trees desired.

These arrangements should be made one or two years in advance of planting to insure that the nursery will have the desired rootstocks upon which to bud the trees. The grower or nurseryman will cut the buds from the tree or trees to be propagated and this will offer greater assurance that the grower will get the variety or varieties desired.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 39 (No. 3)
MAY–JUNE 1974

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

BEE NOTES FOR ORCHARDISTS
Spring, 1974

D.C. Newton
Apiculturist, Department of Biological Sciences
Central Connecticult State College, New Britain, Ct. 06050

Orchardists must know enough about beehives, pollination, and bee behavior to provide the kind of orchard management that will result in setting a commercial crop. These notes are designed to provide such information.

What is a Beehive?

Honey bees are always found in a social unit called a colony consisting of a queen, her daughters called workers, and a relative few of her sons called drones. Colony worker populations vary from less than 10,000 to approximately 60,000. Population fluctuation occurs throughout the season depending on the colony's history, time of year and present-past floral conditions. Each colony is housed in a modular hive that may be expanded to suit the needs of the individual colony. It is important for the orchardist to realize a puny colony may be housed in a large hive made of one or more modules (called brood chamber and supers). Value of the colony for pollination depends on the size of the colony, not the size of the hive.

Why do Bees Pollinate Flowers?

An individual honey bee worker lives about six weeks during the active season. Only a part of this time is spent gathering pollen and nectar in the field. Each colony is constantly engaged in rearing replacements for workers as they die in the fields of old age and predators. The only source of protein to the bees is pollen gathered from flowers. It is collected and used in large quantities to feed young bees (called brood) as they grow to adulthood. Therefore, a colony with brood is a better pollinating unit than one with adult bees lacking brood. Pollination occurs when pollen grains sticking to the hair coat of a bee are transferred from the anthers of one flower to the stigma of a compatible flower. Certain wild bees and honey bees are good pollinators because they have a dense hair coat and each hair is built like a small brush.

Why Move Honey Beehives to an Orchard?

Several kinds of wild bees can set a fruit crop. However, their numbers vary from year to year and they may be killed by spraying of the orchard or adjacent areas. By placing honey bees in the orchard, the orchardist knows that adequate pollination will occur unless the weather is very unusual. The worse the weather, the greater the importance of having honey bees in the orchard to swiftly

set a crop when a short period of good flying conditions occurs. In summary, moving honey bee colonies to the orchard increases the control of the orchardist over pollination and insures an adequate fruit set. In addition, the incidence of misshapen fruit caused by partial pollination and loss of crop because of light bloom or bad weather may be reduced or eliminated.

How Many Honey Bee Colonies are Required for Adequate Pollination?

Obviously, many factors influence the answer to this question. Generally, one colony per acre is recommended. Hives may be arranged singly or in groups of four in various locations. Grouping in fours is superior because colonies competing with one another increase the number of workers flying from tree to tree thereby increasing the number of flowers being cross-pollinated. Peculiar planting patterns may require a different number of hives and require special management plans.

How Do I Know I am Renting Colonies of Significant Size?

In New England, there are two sources of bees used for pollination; colonies that have survived the winter and those established in the spring from a package of workers and a queen shipped from the southern United States. Overwintered colonies are best for pollination. They begin to rear brood (young bees) in large numbers in March and by late April the colony should be increasing rapidly in adult population and quantity of brood. Such colonies are ideal for orchard pollination. Packages are frequently established in the North in late April and early May. They consist of two or three pounds of bees (about 6-9000) and a queen. Because it takes 21 days to rear a bee to adulthood, the adult population of a package colony will decline for at least 21 days after they are placed in a hive. Therefore, this unit will very likely have a reduced adult population at the very time pollination is desired. A colony rented for pollination should have at least three to four combs (frames) of brood and the necessary adults to care for the brood. The modules making up a bee hive come in several sizes. The combs referred to above are 8-7/16" x 16-3/4".

An orchardist should have a letter of contract with the beekeeper specifying three to four combs of brood in every colony rented for pollination regardless of the hive size. An orchardist should have the right to inspect colonies provided for pollination to see that the size requirement is met. This need not be a dangerous procedure. An alternative is to have the beekeeper open and display colonies randomly chosen by the orchardist. Brood combs may be identified by the dense covering of bees. Covers may be removed from comb cells revealing developing young bees. Each box usually has nine or ten combs in wooden frames. Brood containing frames are at the bottom of the hive or sometimes in the second box (super).

Cost of Renting Bees

An orchardist should not be surprised to be charged $15 or more for each colony moved to his orchard. The cost figure (1974) will be quickly outdated. The orchardist is not doing the beekeeper a favor by using his bees. Proper pollination requires planning labor, equipment and time. In addition, it risks pesticide losses to the beekeeper. Populous colonies are easily worth the price because they have 6-7 or more frames of brood. A beekeeper should have a letter of contract specifying a penalty if the orchardist sprays and kills his bees. In addition, a date when the bees are to be removed should be specified (so the orchardist can continue his spray program). Many beekeepers no longer wish to pollinate orchards because their bees have been needlessly killed in the past. A penalty for pesticide loss in the orchard should equal the potential honey crop value for the year -- about $60 (1974) per colony.

How Long Should Honey Bees Remain in the Orchard?

Bees can set a crop in two good flying days (temperature above 65 and partial sun). Frequently, bees become accustomed to working dandelion which blooms at about the same time as apple trees. For best results, bring the bees into the orchard when there is early partial bloom. When the bees leave their hives in the new location, they begin work nearby first (in the orchard) and progressively work further from their hives. "Late" move into the orchard helps insure that bees will work in the orchard before they discover a more attractive bloom up to two miles away (outside the orchard). If there is no significant competition, then there is no problem. Pay particular attention to this procedure when pollinating pears. Bees prefer apple blossoms to pear blooms. After full bloom, bees should be removed as soon as possible (from the orchardist's standpoint).

Where do I Find Populous Colonies for Rent?

There are plenty of beekeepers in New England. However, many lack trucks to move their bees. The orchardist is advised to contact the beekeepers in his area (beekeepers are registered with town clerks) and work out an arrangement where he provides trucks and help to move bees into and out of the orchard under direction of the beekeeper. An agreement should describe how the parties will provide equipment and labor to accomplish the job. A few hours in an apiary can show an orchardist how to help move bees without danger. It is a matter of having and using proper protective equipment. Some beekeepers provide complete pollination service. Be sure you know what you are renting and specify the strength of each colony rented as noted previously. Remember, overwintered colonies are best if they are available and well worth the additional time and trouble required to bring them to the orchard.

Can an Orchard Block be Made to Yield it if Was Misplanted and Lacks Proper Cross Pollination?

Yes, you can purchase compatible hand collected pollen from the South and place a special entrance on bee hives which force bees leaving the colony to walk through the purchased pollen. Then, as they fly from bloom to bloom, they will set a crop. This procedure does require time and prior planning but is worth the investment.

What Varieties of Apples and Peaches are Self-Sterile?

Some varieties, including Delicious, McIntosh, Red Astrachan, Mutsu, Wealthy and Northern Spy are known to be self-sterile. On the other hand, Baldwin, Oldenburg, Early McIntosh, and Yellow Transparent are known to be partially self-fertile. Even self-fertile varieties produce larger fruit when cross-pollinated. Many peaches are self-pollinated but Hale and Mikado are known to be self-sterile. Even in the case of self-fruitful varieties, bees are important to the transfer of pollen with individual flowers.

SOURCES OF HONEY BEE INFORMATION

Journals and Addresses for Subscription

The Connecticut Honey Bee
P.S. Hewett, Jr.
Route 2
Litchfield, Conn. 06759
(A publication of the Conn. Beekeepers Assoc. 4/year at $3.00)

Gleanings in Bee Culture
The A.I. Root Co.
Medina, Ohio 44256
12/year at $4.50

American Bee Journal
Hamilton, Illinois 62341
12/year at $4.50

Bee World
Bee Research Association
Chalfont St. Peter,
Gerraris Cross
Buckinghamshire
England SL9 ONR
4/year at $8.50

Catalogs of Bee Equipment

Dadant and Sons
Hamilton, Illinois 62341

A.I. Root Co.
Medina, Ohio 44256

Walter T. Kelley Co.
Clarkson, Kentucky 42726

Books

The Hive and the Honey Bee
edited by Ray A. Grout
(Dadant and Sons, Hamilton, Illinois 62341)

ABC + XYZ of Bee Culture
(A.I. Root Co.
Medina, Ohio 44256)

****

POMOLOGICAL PARAGRAPH

Leaf analysis program: Grower participation in our leaf analysis program in 1973 was disappointing in comparison to 1972. Leaf analysis of established fruit plants provides the most reliable information of nutrient needs. It can determine nutrient shortages and excesses, and shows nutrient balance. Frequently, leaf analysis shows that certain fertilizer elements are not needed, which saves you money. One grower, for example, has not applied nitrogen (N) on some blocks of McIntosh trees for 4 years and leaf analysis in 1973 showed the N level in his orchard still to be somewhat high. Many growers are concerned about calcium (Ca) levels in their apple trees. Other nutrients must be kept in balance with the Ca for apple trees to utilize Ca efficiently. Leaf analysis is the only means by which we can determine the level and balance of the essential elements. Therefore, we strongly urge greater participation in our 1974 leaf analysis program. It could make and/or save you money!

****

SAT - THE SINGLE APPLICATION TREATMENT WITH DIFOLATAN FOR EARLY SEASON APPLE SCAB CONTROL

C.J. Gilgut
Department of Plant Pathology

One spray for scab at the beginning of the growing season which controls scab up to petal fall without additional scab sprays appeals to growers. It can be a "peace-of-mind" program.

SAT has given good scab control for several years in experiments. But, it is a new method and, as with any new method or new pesticide, we need to learn how it will work for growers in their orchards when applied with different spray equipment, during different seasons, and with different weather conditions. Some growers have already tried the method. Those who followed directions carefully got good scab control; others who were careless, made mistakes, or tried short cuts, got poor control.

A review of the SAT method should help growers understand it and get better results, and an account of some of the reasons for poor results may help avoid them in the future.

The SAT Method: A heavy dosage of fungicide is sprayed on the trees at Dormant to 1/4 Inch Green Tip. Enough fungicide is deposited on buds, twigs and branches for distribution during rains in sufficient amounts to protect new growth for about four weeks during the early part of the season, usually up to Petal Fall.

Beginning with Petal Fall, the regular program with a standard scab fungicide is followed. However, in some years tree growth and weather conditions are such that the regular program should be started before Petal Fall. For example, tree development from Green Tip to Petal Fall is usually from the third week in April to the third week in May, about 4 weeks. In 1973, it was not 4 weeks but 6 weeks and, in some places 7 weeks; in addition, the entire month of May except for a few short breaks was a continuous wetting period. Growers who waited until Petal Fall did not get good scab control. Obviously, a grower needs to remain alert and use judgement whether to wait until Petal Fall to start the regular program or whether to start it earlier. If in doubt, he can include a scab fungicide in rust or powdery mildew control sprays if they are needed or in insect sprays which are started before bloom.

What to use: Difolatan 4 Flowable is the only fungicide registered for the Single Application Treatment. Other scab fungicides have been tested but do not give satisfactory results. Difolatan irritates eyes and skin of some people. Observe all safety precautions.

When: The spray is applied on trees at Dormant to 1/4 Inch Green Tip. It usually causes some crinkling of cluster leaves. If applied later than 1/4 Inch Green Tip, there may be leaf injury and fruit russet on some varieties.

How much to apply: Five quarts in 100 gallons of dilute spray is applied at 400 gallons per acre of standard mature trees. This is 20 quarts or 5 gallons of fungicide per acre.

Concentrate sprays at 3X or 4X may be used provided the same amount of fungicide is deposited on the buds, twigs and branches as with 400 gallons of dilute spray. The full amount, 20 quarts or 5 gallons per acre is needed if it is to protect long enough. Do not reduce by 20 to 25% to compensate for no run-off or drip as is done in concentrate spraying in regular programs. Growers who cut the dosage in concentrate sprays in 1973 had disappointing scab control. In order for SAT to work, the maximum amount of fungicide has to be applied to buds, twigs and branches.

Some adjustment in number of gallons applied per acre may be necessary because of tree size and spacing. High density plantings with narrow rows may require as much as mature standard trees. Non-bearing or small trees with wide row spacing probably need less. What is important, is that enough gallons are used to provide an adequate deposit of fungicide on buds, twigs and branches.

Some Reasons for Poor Results with SAT

1. Insufficient deposit because:
   (a) Sprayer inadequate - does not deposit enough fungicide in the tree, especially the tops, from where the fungicide redistributes to growth below.
   (b) Nozzle size and arrangement not good. Spray pattern does not give proper coverage.
   (c) Sprayer not calibrated - Some growers do not know how much material the sprayer is applying per acre and some do not know how big an acre is.
   (d) Sprayer speed too fast - especially with concentrate spray.
   (e) Spray dosage in tank reduced for concentrate spray - a common mistake.

2. Unfavorable weather conditions when SAT spray is applied.
   (a) Too windy - Gusts of wind deflect spray as sprayer passes tree. No spray is deposited either in entire trees or in some parts of trees, especially the tops.
   (b) Rain when SAT spray is being applied or before it dries on the tree. Too much washes off so that what is left is not enough to redistribute in later rains to protect new growth.
   (c) Frequent and heavy rains wash away dried spray deposit so there is not enough to protect up to petal fall and grower does not start regular scab protection soon enough.

3. Tree development longer than 4 weeks from Green Tip to Petal Fall.
   Don't expect SAT to protect more than 4 weeks under normal weather conditions. May need to start regular scab program in Pink.

4. SAT is a one-spray program. Inadequate deposit or misses cannot be corrected by following sprays, as with the regular multi-spray program, because there are no following sprays for several weeks.

Difolatan and oil mixture may cause serious leaf injury and fruit russet. This should not be a problem, because Green Tip is too early to start insect control with oil.

Adapting SAT to Insect Control Programs that Start in Tight Cluster or Pink

Some growers start insect control in Tight Cluster or Pink, at which time they are able to include scab fungicides in the insect sprays. Such growers may want SAT scab protection up to the time they start spraying for insects which would be two or three weeks after Green Tip. Dr. M. Szkolnik of the Geneva, New York Experiment Station has had some success in programming the SAT application to

give one, two or three weeks scab protection, as desired, by adjusting the amount of fungicide in the spray tank and applying at 400 gals. per acre. This is still in the experimental stage, but he believes that 1 quart to 100 gallons dilute (one gallon Difolatan per acre) may give one week of protection, two quarts per 100 (2 gallons/A) may give two weeks protection, and 3 quarts per 100 (3 gallons/A) may give three weeks protection. He is not yet ready to make recommendations.

****

USE OF ETHEPHON (ETHREL*) TO INITIATE FLOWER BUD DEVELOPMENT ON APPLE TREES

W.J. Lord and Duane Greene
Department of Plant and Soil Sciences

Growers are interested in ethephon's ability to promote spur development and flower-bud formation on young apple trees. To induce this response, the label gives the following directions:

"To increase flower-bud development in both spur and non-spur type young non-bearing trees, apply a foliar spray of Ethrel 1 or 2 weeks after peak bloom period (as determined by bearing trees in the area). On young trees just beginning to initiate a few flowers, treat 4 to 5 weeks after full bloom to minimize over-thinning and misshapen fruit (calyx end pinched). Reduced vegetative growth and increased bud development during the season of application should increase flowering the following spring. Trees should be large enough to support a set of apples before they are treated to initiate flower buds.

I. Spur-Type Trees: Mix 1-1/3 pints of Ethrel* in 100 gallons on water (5 pints in 300 gallons). Spray trees thoroughly and uniformly to the point of runoff.

II. Non-Spur Type Trees: Mix 3-1/3 pints of Ethrel* in 100 gallons of water (10 pints in 300 gallons). Spray trees thoroughly and uniformly to the point of runoff. This rate may completely defruit trees.

Treat when air temperatures are between 60°F and 90°F."

Our studies show that concentrations much less than those suggested on the label will reduce fruit set drastically when applied anytime from full bloom to the completion of June drop. Therefore, we will continue to suggest that ethephon not be used on young bearing trees if fruit thinning is undesirable.

*Trade name

Our trials with ethephon usage to promote flower-bud initiation on young non-bearing trees, large enough to bear a crop, are still limited. Our preliminary data in 1973 indicate that 1-2/3 to 3-1/3 pints of ethephon per 100 gallons of water applied 3 weeks after full bloom suppressed vegetative growth on 'Triple Red Delicious', a non-spur type and appears to have increased flower bud formation. More data are needed, however, before we can make specific recommendations concerning concentration and use of ethephon for flower bud initiation. Until such data are available, we can merely suggest that growers follow the label suggestions given above for increasing flower bud development on young non-bearing trees.

****

POMOLOGICAL PARAGRAPH

Diuron now labeled for use under peach trees. EPA has approved labeling of diuron (Karmex*) for control of annual weeds such as foxtail, crabgrass, pigweed, lambsquarters, ragweed, purslane, chickweed and mustard under peach trees. The best use of diuron is as a tank mix with paraquat. Make a single application in mid-May of two to five pounds of diuron plus one quart of paraquat with a spreader per treated acre.

Use the lower rates of diuron on lighter soils and higher rates on heavier soils. Do not use this combination spray on sand, loamy sand or gravelly soils, nor on soils containing less than 1% organic matter, as injury to the trees may occur.

The label includes the following important precaution:
"Use only where trees have been established in the orchard for at least 3 years. Avoid contact of fruit or foliage with spray or drift. Do not apply within 3 months of harvest. Do not replant treated areas to any other crop within 2 years after last application as injury to subsequent crops may result."

*Trade name

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

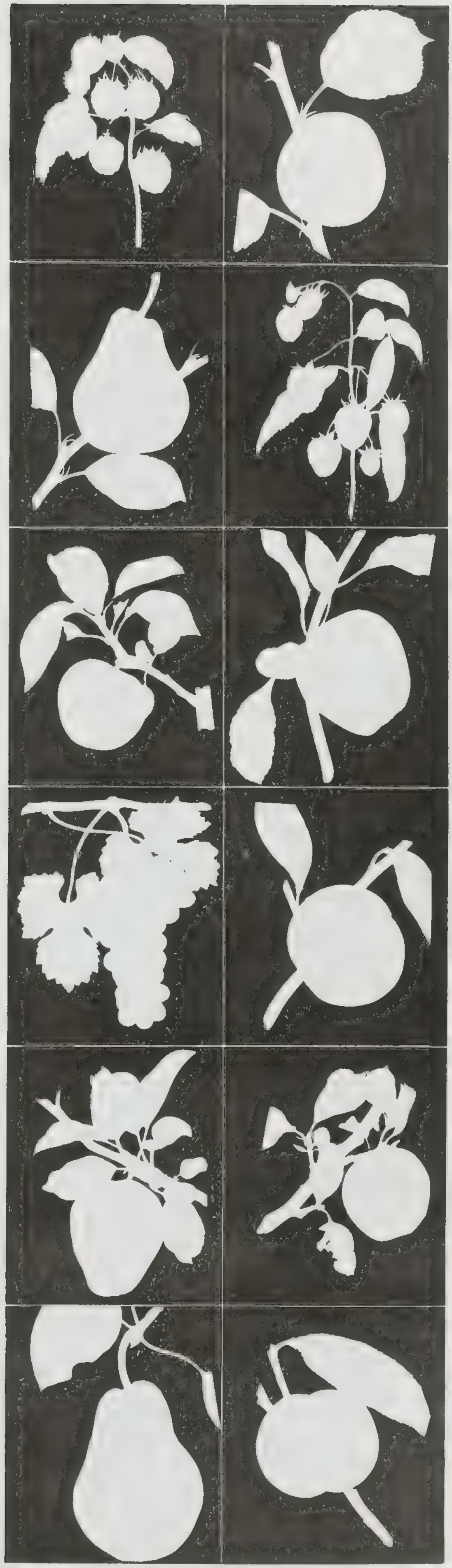
WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914
--
Official Business
Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES



PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

VOL. 39 (No. 4)
JULY–AUGUST 1974

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

SUGGESTIONS FOR THE USE OF ETHEPHON (ETHREL*) FOR PROMOTING UNIFORM RIPENING AND RED COLORING ON APPLE TREES

W.J. Lord and D.W. Greene
Department of Plant and Soil Sciences

Ethephon is proving to be of significant value to both producers and consumers of apples because a preharvest application of this material will stimulate red color development, increase soluble solids and hasten fruit maturity. These responses make it possible to advance the marketing season of apples and to have high quality fruits for these early sales. Furthermore, this chemical enables the grower to harvest a larger percentage of his crop from the trees at the first picking. Nevertheless, misuse of ethephon and/or an unavoidable delay in harvest following its use could intensify our current problems of supply management and poor fruit condition with the McIntosh variety. The placement in marketing channels of an excessive volume of ethephon-treated McIntosh apples that must be sold quickly because of over-maturity could depress price. <u>Ethephon must be used with caution</u>!

Successful Use of Ethephon

Ethephon will not completely overcome conditions unfavorable for development of red color. Our experience the past two years has been that ethephon treatments added only about 10-20% red color to apples within 7 days after application. Under conditions that are normally associated with poor fruit color, such as high temperatures, excessive vigor, or dense trees, the ability of the fruits to develop red color may be so low that adding ethephon still will not bring color up to satisfactory levels. Therefore, ethephon is most useful on young trees of medium vigor or well-pruned, medium-sized trees of moderate vigor from which a high percentage of well-colored fruits are normally harvested in one picking. Despite use of ethephon, large, dense trees will still have many fruits in their interior with inadequate red color. By the time these poorly colored fruits obtain adequate color, they will probably be too soft and thus suitable only for juice or immediate sale. The problem of obtaining adequate color on the interior fruits of large dense trees can be corrected somewhat by pulling the water sprouts during the summer and doing some light summer pruning. These procedures should be followed by spot picking, which will lighten the crop load and permit better light penetration into the interior of the tree before the application of an ethephon spray.

Apply the ethephon spray when good drying conditions are anticipated for at least 6 hours after spraying. For best results, thorough coverage of the fruits and leaves is needed. Good sprayer calibration is essential to insure uniform coverage and to avoid over-application. Apply ethephon at 1X and use no spreader-sticker.

Use on early varieties. Ethephon is a very useful tool on early varieties such as Early McIntosh and Puritan. In general, a single application applied 7-10 days before normal harvest at 1/2 pint per 100 gallons of water will increase red color development within 4-5 days and permit the harvest of a high percentage of the crop in one picking. Nevertheless, early varieties are notorious for uneven ripening. Therefore, it may be advisable for some varieties to make one picking to remove the riper fruit and then apply ethephon. This should help minimize the problem of over-ripe fruit at harvest. Some growers may wonder about the possibility of spraying the ethephon, then picking the ripe fruit that day, or 1 or 2 days later. Although the ethephon-apple label is not definite with regard to pre-harvest interval, AmChem, the manufacturer of ethephon, prefers to discourage the spraying of this chemical and harvesting the same day or 1 or 2 days later. Harvesting the mature fruit and then applying the ethephon is the preferred practice. Ethephon applied alone accelerates fruit drop. Therefore, naphthaleneacetic acid (NAA) should be used with the ethephon to counteract this abscission effect.

Once the color benefit from the ethephon-stop-drop spray combination becomes apparent, color develops quickly. Therefore, beginning the 3rd day after applying this combination spray, you would do well to look at the fruit at least twice a day. The fruit should be picked as soon as color is adequate in order to minimize firmness loss.

Use on McIntosh. A single application of ethephon applied 2-3 weeks before normal harvest at concentrations ranging from 1/4 to 1 pint per 100 gallons of water (assuming 400 gallons of spray mixture per acre at 1X) will increase red color development within 7 days after application. Fruit color will continue to increase at a faster rate than on non-sprayed trees. This response is accompanied by fruit flesh softening; the degree of softening is associated with the concentration of ethephon applied and number of days from application to harvest of the treated fruits. McIntosh fruits sprayed with only 1/12 pint of ethephon may be excessively soft 21 days after treatment, being suitable for immediate use only.

Ethephon-treated fruits will keep well in regular storage provided they are in good condition at harvest. Scald may develop to a greater extent on stored fruit that has received ethephon than on non-treated fruits.

Ethephon should not be applied earlier than 3 weeks prior to normal anticipated harvest because fruit quality could be reduced. A mid-July application of Alar-85* on trees scheduled to receive ethephon is of benefit. Although Alar-85* is ineffective for drop control on ethephon-treated trees, it will help maintain fruit-flesh firmness.

NAA or 2,4,5-trichlorophenoxypropionic acid (2,4,5-TP) must be used to counteract the abscission effect of ethephon. A single ap-

plication of NAA is effective for only 7-10 days. Therefore, its use may involve 2 applications of NAA and the risk of unfavorable weather which may delay the second application or picking. The 2,4,5-TP may cause more ripening than NAA, but it does eliminate the chance of excessive fruit loss following an ethephon application.

Basically, there are 3 time periods for sale of ethephon-treated McIntosh fruits--prior to normal harvest time, during normal harvest, and from storage. The volume of fruits sprayed with ethephon should be based upon anticipated sales during one or more of these sale periods. The harvest of ethephon-treated fruits must not interfere with the timely harvest of fruits for CA storage since at present the placement of ethephon-treated fruits in this type of storage is not recommended. Although our data shows that ethephon-treated fruit which still are in good condition will store satisfactorily in CA, we are concerned that apples not in good condition will be stored.

Fruit to be placed in storage at 32°F must be picked at proper maturity. Fruits to be sold through January 1 should receive no more than 1/4 pint of ethephon per 100 gallons of water (See Table 1) and be harvested 7-10 days after treatment. Although these fruits should store well until January 1, they may be softer than Alar-treated fruits.

Suggestions for Use

In the table below are our suggestions for ethephon use. Ethephon should prove beneficial if used properly.

Table 1. Suggested use of ethephon for promoting uniform ripening and red coloring on apple trees.

Purpose	Compound, timing and rate
Early varieties To promote uniform ripening and red coloring	Ethephon - 7-10 days prior to normal harvest - 1/2 pt/100 gals plus NAA - same timing as ethephon spray 10-20 ppm
McIntosh Sales prior to normal harvest	Alar-85* - mid July - 1 lb/100 gals plus ethephon - 2 to 3 weeks prior to normal harvest - 1 pint/100 gals plus 2,4,5-TP - same timing as ethephon spray - 10-20 ppm.

Purpose	Compound, timing and rate
Fruits to be held at 32°F in air for 1 month or less	Alar-85* - mid-July - 1-1/2 lb/100 gals plus ethephon - 2 weeks prior to normal harvest - 1/2 to 2/3 pt/100 gals plus NAA or 2,4,5-TP - same timing as ethephon spray - 10 to 20 ppm
Fruits to be held at 32°F in air as late as January 1.	Alar-85* - mid-July - 1-1/2 lb/100 gals plus ethephon - 2 weeks prior to normal harvest - 1/4 pt/100 gals plus NAA or 2,4,5-TP same timing as ethephon spray - 10 to 20 ppm.

*Trade name

****

REPORT ON APPLE MAGGOT CONFERENCE

J.G. Stoffolano, Jr.
Department of Entomology

A conference on apple maggot research in the Northeastern United States and Canada was held on March 27-28, 1974, at the New York State Agricultural Experiment Station, Geneva, New York. Twenty-seven participants in this area of research attended, including 6 Canadians.

Topics covered included:

1. *Apple Maggot Population Monitoring.* The relative effectiveness, spacing and positioning of various traps. Uses of traps in orchard monitoring. Improvement and future development of monitoring systems.

2. *Apple Maggot Management and Control.* Chemical control, alternate control measures (habitat manipulation, trapping, hormones and pheromones, and male sterile release programs).

3. *Laboratory and Mass Rearing Techniques.* Artificial diets, handling techniques, and artificial oviposition systems.

4. *Ecological and Behavior Research Needs.* Population dynamics, life tables, behavior, dispersal and host orientation.

5. *Regional Communication and Cooperation.* Discussion of means of providing future regional communication and delineation of areas of possible cooperative research.

Dr. Ed Glass, head of the Entomology Department, reported that in all of their research programs with delineation, altering and reducing the number of sprays, the apple maggot has been their most serious pest. It is apparent that most of the apple maggot problem in commercial orchards comes from abandoned orchards, home trees and possibly some hawthorn species. The flies apparently migrate from these areas into commercial orchards. In order to monitor this movement, a couple of different traps have been used. The yellow trap is most effective in catching female flies with undeveloped ovaries while the red traps are most effective in catching females ready to lay their eggs into the fruit. Workers in Connecticut have found that the yellow traps are more effective than the red sphere traps in defoliated trees while the reverse is true in foliated trees. One of the most important results of the meeting was the standardization of the two traps used. The yellow trap is to be made from the top portion of the ICY Pherocon trap and is to be coated with the adhesive/attractant consisting of ammonium acetate (50%) and HyCase (50%). The price of each trap is $0.35. The red spheres will be an 8 cm diameter plastic ball painted with two coats of Red Tartar paint. The price per trap is $0.65 for less than 1000 traps, or $0.55 for more than 1000 traps. Dr. Gary Jensen, Extension Entomologist, will be conducting a trapping program using these traps this summer in both the University Orchard and commercail orchards. At the same time, Dr. John Soffolano will be evaluating the reproductive condition of the flies caught in these traps. Such trapping programs are designed to help the grower time his sprays and possibly to help determine population levels.

Another topic that raised considerable discussion was that of the flight capabilities and dispersal characteristics of the adult flies. The Canadian researchers felt that if old abandoned orchards were removed from within one-quarter mile of commercial orchards, the growers would be protected. This, however, would depend on the type of habitat existing between the old trees and the orchard. Michigan researchers felt that the adults could travel up to one-half mile. It was evident that more research in this area is needed. In one study, it was shown that 1.2 to 1.5% of the adult flies in an unsprayed orchard were leaving those orchards. Why they were doing this and where they were going was not determined.

Workers at Geneva sprayed an abandoned orchard one year and then left it unsprayed to determine the rate of re-infestation of maggot. The year the orchard was sprayed no maggots were found in the fruit. The first year after discontinuation of spraying, fruit

were not sampled. However, in the second year after discontinuation, 3% of the fruit were infested with maggot; in the third year, 78% were infected; and in the fourth year 100% were infested with maggot. From then on, the percentage of infested fruit never went below 85% and was normally 100%. Gravenstein was found to be the most susceptible variety, and the one most preferred by the maggot. They concluded from the study that maggot was the most serious pest in unsprayed apple orchards.

In general, it was agreed that areas that needed considerably more research were:

1) What the natural foods of the flies are in the natural state, and what role these foods play in their reproductive development.

2) Migration and dispersal ability of the flies.

3) Development of a more effective attractant.

4) The possibility of some type of pheromone produced by either sex, since pheromones are rather common in other members of this group.

It was agreed upon that this conference would continue to be held annually for several years to come. Dr. Ed Glass of the Geneva Experiment Station was elected chairman of this annual conference.

****

CHEMICAL CONTROL OF SPROUTS AROUND APPLE TREES[1]

Benjamin L. Rogers
University of Maryland Fruit Lab, Hancock

Sprouts (suckers) under apple trees are shoots that originate from the roots or lower part of the trunk. They occur naturally or originate in the vicinity of roots or trunks damaged by rodents and mechanical equipment. It is necessary to cut these sprouts at ground level as part of the overall pruning procedure, but this merely increases their number because shoots develop from buds on the remaining stubs. The severity of suckering varies considerably among rootstocks as well as among rootstock-scion combinations. Luce (1973. *The Goodfruit Grower* 23:4) reported that sprouts can be controlled with a brush killer combination of 2,4-D and 2,4,5-T. He suggested pruning the sprouts in early March and then applying the brush killer mixed 1 part to 19 parts of heating or spray oil on the exposed stubs. The two chemicals in the brush killer are

[1] Based on an article originally appearing in *The Maryland Fruit Grower* 44(1):6-7.

Table 1. Control of sprouts around 'Starkrimson Delicious' apple trees with sprays of ammonium sulfamate (AMS) and paraquat.

Material and rate	Dates sprayed	Control rating* Dec. 1970	Control rating* Nov. 1971	Sprout removal Dec. 1970 (min/tree)
AMS, 60 lb/100	5/22/70 5/25/71	0.9	0.3	0.4
AMS, 60 lb/100 plus Spreader WK, 4 oz/100	5/22/70 5/25/71	0.8	0.1	0.3
Paraquat, 1 qt/100 plus X77, 1/2 pt/100	5/22/70	2.9	---	0.7
Paraquat, 1 qt/100 plus X77, 1/2 pt/100	5/22/70	2.7	---	0.8
Check	-------	5.0	5.0	1.1

*Rating: 0-good control, no live sprouts; 5- no control

****

BENEFICIAL ORCHARD INSECTS

G.L. Jensen
Department of Entomology

Although there are many insects which may be observed in any given orchard, many are of little or no consequence. Most orchardists hopefully are able to recognize the harmful species, or the damage done by them, but few are aware that beneficial insects are also at work in their orchards. The following information, descriptions and pictures are provided in hopes that some of the more common beneficial insects might be recognized and protected by orchardists.

Assassin bugs (Fig 1) are about 1/2" long or longer, usually black or brown with an abdomen which is often widened at the middle. A few members of this family are known as "kissing bugs" and will bite man to obtain blood; however, most are predacious on other insects such as honeybees, leafhoppers and caterpillars. Many will inflict a painful bite if carelessly handled.

Ant lions (Fig 2) are of little or no consequence to orchardists, since the larvae eat only ants and other ground crawling insects. However, the larvae are similar to those of the lacewings considered next (shown in Fig 3).

potent growth regulators and it is questionable whether 2,4,5-T will be approved for use in apple orchards. Another drawback of the stub treatment is that it would be tedious. Therefore, an easily applied and safe chemical means of sprout control is still needed.

A vigorous block of spur-type 'Delicious' trees growing on seedling rootstocks near Hancock, Maryland, was used to test the effectiveness of two commercially available herbicides for sprout control: (1) ammonium sulfamate (AMS)[2] with and without the wetting agent Spreader WK and (2) paraquat, with and without the wetting agent X-77. Both herbicides are labeled for use in apple orchards, but the label does not specifically mention sprout control. The sprouts were pruned during the dormant season and regrowth was thoroughly sprayed at rates no higher than recommended for general weed control with a knapsack sprayer on May 22, 1970. The AMS sprays were repeated on May 25, 1971, but not the paraquat treatment because of poor sucker control in 1970. Applied on a row basis, all treatments were made to 14 or more single trees. Rates used and results obtained are shown in Table 1.

AMS with or without Spreader WK gave good initial kill of sprayed sprouts but some short and slender regrowth occurred later in the season. Paraquat caused some leaf chlorosis and crooked growth but failed to kill the sprouts. The pruning time required to remove the sprouts from the check trees was slightly over 1 minute per tree; whereas, approximately one-third the time was needed where AMS was used. The slight suppression of growth by paraquat was reflected by some decrease in pruning time as compared with check trees.

The AMS sprays were repeated on the same trees on May 25, 1971. Sprout control was better than in 1970 and little regrowth occurred. These results indicate that AMS sprays will satisfactorily control young sprouts around apple trees if thoroughly sprayed in mid- to late May, or when the sprouts are only 6 to 8 inches tall. Old woody sprouts from the previous year might not be killed.

AMS should not be used around trees younger than 3 years due to the danger of bark injury. It is not translocated into the tree, but is effective for the rapid killing of young sprouts.

When applying AMS, no spray should contact fruit or foliage as injury will occur. Spray equipment should be rinsed and cleaned <u>thoroughly</u> after <u>each</u> use because of the corrosive nature of AMS.

---

[2] Ammate X*

Lacewings (Fig 3) are predacious in both the adult and larval stages. They eat chiefly aphids and the larvae are often called "aphidlions." The larvae taper at both ends and are yellow or gray mottled with red or brown. They have double sickle-shaped jaws with which they capture, puncture and suck the juice from aphids, mealybugs, thrips, and mites. Adults are a beautiful green and have golden eyes and long, hairlike antennae. The eggs are an oval white, and are placed on twigs or foliage at the ends of hairlike stalks about 1/2" long so that the cannibalistic larvae will not eat other unhatched eggs.

Ground beetles (Fig 4) are large, usually 3/4" or longer, and generally shiny, dark and flattened. Nearly all members of this family are predacious on other insects and some are highly beneficial. One, the European ground beetle, a large beetle with beautiful irridescent blue green color, was imported to aid in the control of gypsy and brown-tail moths. Although called ground beetles, these insects often climb trees and shrubs in search of prey.

Syrphid flies (Fig 5) are often observed hovering about flowers in the adult stage. Many are brightly colored and resemble various bees and wasps; however, none of the species found will bit or sting man. The larvae in orchards are predacious for the most part on aphids.

Parasitic wasps (Fig 6) are among the most beneficial of all insect families, They are cosmopolitan in distribution, and parasitic in the immature stages. Members of the family Ichneumonidae are very numerous, this family being one of the largest in the insect class. The adults vary considerably in size, form and coloration, but the majority resemble slender wasps, and the ovipositor is usually quite long, often longer than the body. The ichneumons attack a great variety of hosts, there being very few groups of insects which are not attacked by some member of this family. Adults are active fliers and usually go unobserved by most orchardists unless the insect fauna are routinely observed with keen eyes.

The brachonids are also very numerous, but somewhat smaller and more stout-bodied than the ichneumons. Members of this group also attack a wide variety of insects, but sawflies, aphids, caterpillars and flies such as the apple maggot would be those of most interest to orchardists.

Ladybird beetles (Fig 7),of which there are many species, are perhaps the most common and best known of all aphid predators. The yellow-orange eggs of these beetles are laid in small groups on leaves of plants which usually are infested with aphids. The "alligator-like" larvae (Fig 7) are black or blue with yellow or orange. They commonly pupate on the plant leaves, and although stationary as pupae, they exhibit an interesting protective trait of jerking back and forth when disturbed by another organism. Adult lady beetles often live a full year and may fly from plants in one area to those in another area many miles distant during their life-

time. Lady beetles that migrate long distances between habitats are very difficult to establish locally by man in his efforts to promote the control of pest aphids by this means. On the other hand, many lady beetles that prey on more stationary host pests (such as scale insects) have been introduced into new environments quite successfully. A small black lady beetle *(Stethorus)* has been encouraged via pest management techniques in Pennsylvania and is apparently doing a good job of controlling orchard mite populations in that area. Ladybeetles are predators in both the adult and larval stages. Adults most often observed are the reddish-orange beetles generally with black spots (Fig 7); however, there are many darker, smaller species which feed on scale insects, mites and mealybugs. The reddish-orange species generally feed on aphids of almost any species, and occasionally on the eggs of moths.

Predacious Stinkbugs (Fig 8) are not numerous in most orchard situations and additionally they often prey on beneficial species such as lacewings and lady beetles. For these reasons, their usefulness to orchardists is probably minimal.

Praying Mantids (Fig 9) have received much attention as predators during the past decade, and mantid egg cases may be purchased and attached to trees and shrubs in gardens. Their fame is probably not entirely justifiable because of the thousands of young mantids which come out of the egg cases, only a few will survive. They do have avid appetites and eat many insects; however, many of those consumed are either beneficial or are of little or no consequence to the orchardist. They commonly eat their own kind as well. Many of the advertisements about these insects are grossly false in their claims concerning the numbers and types of prey consumed.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

BENEFICIAL INSECTS

An Aid to Identification and Control

1. ASSASSIN BUG

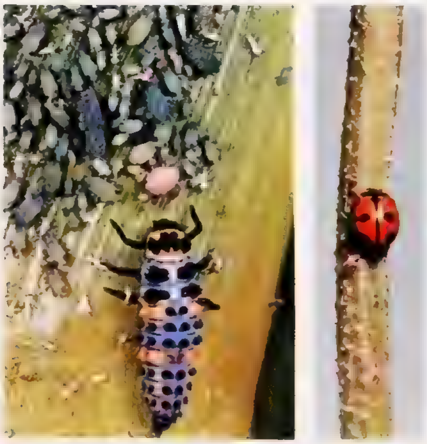
2. ANT LION

3. LACEWING

4. GROUND BEETLE

5. SYRPHID FLY LARVA

6. TOBACCO HORNWORM
Parasitized by Braconid Wasp (Pupal Stage)



7. LADYBIRD BEETLE
Left - Larva Feeding on Aphids
Right - A Typical Adult

8. PREDACEOUS STINKBUG (Top)
Ready to Attack Cabbage Bug

9. PRAYING MANTID

PREPARED BY THE CLEMSON UNIVERSITY COOPERATIVE EXTENSION SERVICE'S ENTOMOLOGY - PLANT PATHOLOGY AND AGRICULTURAL COMMUNICATIONS SECTIONS, FEDERAL EXTENSION SERVICE COOPERATING

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 39 (No. 5)
SEPTEMBER–OCTOBER 1974

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

THE "SOFT McINTOSH PROBLEM"

W.J. Bramlage and W.J. Lord
Department of Plant and Soil Sciences

Once again, in 1973-74, the "soft McIntosh problem" was very serious in the Northeast. The problem is that when McIntosh are removed from CA storage in late spring, they are or rapidly become excessively soft --- easily indented by finger pressure. The retail market cannot accept such fruit, and large economic losses occur.

In 1973, Dr. R.M. Smock discussed this problem at the New England Fruit Meetings (Proc. Mass. Fruit Growers' Assn. 79:97-102). He pointed out that there are many causes of soft apples, including large fruit, high nitrogen, low calcium, over pruning, stop-drop sprays, late picking, delayed storage, slow cooling, high storage temperature, poor air distribution, slow O_2 drop in CA, and over-storage. An individual grower may have a "soft Mac problem" due to any one of these factors, or any combination of them.

When the problem is widespread throughout the region, however, a basic problem seems to exist. Dr. Smock discussed several such possibilities. The frequent recurrence of the problem corresponds with the widespread adoption of Alar* treatments, and therefore, some have implicated Alar* as the cause of the problem. Smock pointed out that if misused, Alar* could indirectly be a cause: Alar*-treated fruit should be harvested at about the same time as untreated fruit, and if their harvest is delayed significantly, these fruit will not hold up in storage. But if Alar* is properly used, there is no basis for blaming the "soft Mac problem" on it. (We shall return to this question later.) Is Ethrel* a cause of the problem? Dr. Smock pointed out that it could be, if misused. McIntosh respond explosively to high concentrations of Ethrel*. But if used properly, Ethrel* has only a small effect on softening. (See the accompanying article.)

Smock reported that Dr. G.D. Blanpied has studied 20 years of weather data from New York and has found a strong correlation between soft apples and dry periods in the summer followed by heavy rains and warm weather prior to harvest. Smock and Blanpied followed this up with an experiment that demonstrated this effect on McIntosh firmness. In 1973, we had a period of dry weather and a period of extremely hot weather prior to harvest that almost certainly caused some fruit softening. It appears that growers should carefully observe the weather pattern during the season, and if a dry period is followed by a hot, wet period, the probability of a "soft Mac problem" is high. Growers should then observe fruit carefully during storage and watch for signs of excessive softening.

*Trade Name

This past spring, we recorded some significant features of "soft McIntosh." During the past two years, we have conducted an experiment with the help of Bill Pearse of the J.P. Sullivan Co. and Joe Costante, Regional Fruit Specialist, to determine if Alar might be increasing the softening rate of McIntosh. Trees were selected in 13 orchards in Massachusetts, and half of each tree was sprayed with Alar* while the other half was not. A bushel sample of fruit from each half of the trees was harvested on two dates one week apart, and they were all stored together in CA at the Horticultural Research Center, Belchertown.

In 1972-73, Alar* fruits in all instances were firmer at harvest than the non-sprayed fruits (Table 1). The firmness difference between Alar* and non-Alar* fruits disappeared somewhat in storage. However, with 3 exceptions, the Alar fruits still remained somewhat firmer at the end of storage than the non-sprayed fruits. The apples kept exceptionally well during this 1972-73 storage period and there were virtually no soft apples among those examined.

Table 1. Influence of Alar* on firmness of 'McIntosh' apples at harvest and after storage.

Treatment	Firmness at harvest		Firmness after CA storage	
		1972-73		
	9/20 or 21	9/26 or 27	Picked 9/20 or 21	Picked 9/26 or 27
Control	17.0 lbs	16.0 lbs	12.8 lbs	12.1 lbs
Alar*	18.0 lbs	16.9 lbs	13.6 lbs	12.7 lbs
		1973-74		
	9/17 or 18	9/24 or 25	Picked 9/17 or 18	Picked 9/24 or 25
Control	15.7 lbs	15.0 lbs	9.6 lbs	9.3 lbs
Alar*	16.4 lbs	15.7 lbs	9.8 lbs	9.4 lbs

In 1973-74, the fruit were considerably softer at harvest than in 1972-73 (Table 1). Once again, the Alar* fruits were firmer at harvest than the non-Alar* fruits, but the firmness difference disappeared in storage. When the fruit was pressure-tested and examined 1 day after removal from CA storage it was apparent the fruits were soft but did not have the characteristic "soft Mac problem." After 4 days at room temperature, however, some lots of fruit developed the characteristic "soft Mac problem," which was more severe in the later picking.

On the average, there was no effect of Alar on firmness after storage (Table 1). Furthermore, within only the samples from orchards that produced soft fruit, there was no difference between control and Alar*-treated fruit. We find no evidence that Alar*, <u>if properly used,</u> is contributing to the "soft Mac problem." We <u>did</u> note, however, that after storage until May, Alar*-treated fruit contained more browncore than control fruit, a response that also has been reported from New York.

Because of some observations in other experiments with calcium on apples, Dr. Mack Drake sampled some of these apples from orchards that produced fruit of different degrees of softening and analyzed them for calcium. The results of these observations were as follows:

Average firmness 5/9/74 of fruit (lbs)	8.2	9.7	10.9	11.8	13.0	13.0	13.2
Peel calcium (ppm):	309	393	327	374	486	608	692

As can be seen, the firmest fruit had twice the amount of calcium in them as the softest fruit. There was a significant correlation between calcium level and firmness; that is, the higher the calcium, the firmer the fruit. However, this represents a very limited number of observations. To obtain additional evidence on this relationship, in May, 1974, fruit of comparable size but clearly different condition were taken from identical boxes of McIntosh that had been grown and stored at the Research Center. When analyzed for calcium, we found the following:

Fruit condition:	Split	Soft	Firm
Peel calcium, ppm:	484	516	606

The firm fruit had a significantly higher calcium level than the split or soft fruit. Thus, there is limited evidence that a low calcium level may be contributing significantly to the "soft Mac problem."

What, then, is the "soft Mac problem?" It is our present belief that it is not a unique problem, but rather an expression of rapid aging and deterioration of the apples. We have noted that these "soft Macs" usually show symptoms of senescent browning in their flesh. This aging could be promoted by any or all of the factors cited by Smock. Furthermore, the correlation of weather and softening, noted by Blanpied and Smock, and our correlation between calcium and softening could be related and contributing to aging. Dry weather impedes absorption of calcium by tree rooots, and so the water stress may be reducing calcium level. Subsequent rain may aggravate this problem by promoting rapid growth, and hot weather may advance maturity. Both low calcium and advanced maturity can hasten deterioration during storage. In this way, all that we know about causes of "soft Macs" can be related, and this relationship corresponds to our observations. Time will tell whether or not this view is correct, but for now it serves as our best model for understanding the problem.

What can a grower do to prevent "soft Macs?" We know of no sure preventative other than early marketing of the fruit. However, careful attention to basic details of fruit growing, handling and storage reduce the problem. Avoid over-fertilizing and over-pruning, and try to maintain annual bearing. Large, soft fruit are especially susceptible to the problem, (although smaller fruits may also develop it) and such fruit should be marketed early. Do not store late-harvested fruit for long periods of time even though they have been treated with Alar*. Their storage life has been significantly shortened before they have come off the tree, because <u>they are already ripe</u>. Use growth regulators with great caution. Stop-drop sprays other than Alar* hasten ripening and shorten storage life, and Ethrel* can promote ripening tremendously. Don't delay harvest of growth regulator-treated fruits if they are intended for late storage!

Cool harvested fruits as quickly as possible, and <u>thoroughly</u>. We suspect that many apples, especially those in bulk bins, are not thoroughly precooled. Store them <u>at</u> the recommended temperature, not <u>near</u> it. We have repeatedly pointed out that a degree or two above the recommended temperature can reduce life dramatically. (How accurate is your storage thermometer?) Maintain air movement in storage so that "hot spots" do not develop.

Nevertheless, the most careful and conscientious grower may still suffer losses from "soft Macs" if his fruit happen to be subject to the problem. We recommend frequent observation of fruit scheduled to be stored until March or later as a precaution. Place several boxes of the largest, reddest fruit (sampled from the lots being stored) in front of the "porthole" in the door. Starting in mid-February, periodically open the porthole and remove 20 or so apples; determine their condition after 5 to 7 days at room temperature. A fairly large sample is necessary for observation because at the onset of the "soft McIntosh problem" only a relatively small percentage of the fruit show it. The best way to determine if any of the fruit are excessively soft is by applying pressure with the thumb. On soft apples, the flesh ruptures readily from the pressure. If your apples do not appear to be "holding condition" as well as they should, market them as quickly as possible.

Obviously, there is no cure for "soft Macs," only prevention. And only care, careful observation, and good fortune can be offered as protectants at this time.

****

ETHEPHON (ETHREL*) ON McINTOSH: RED COLOR WITHOUT RIPENING

W.J. Bramlage, W.J. Lord, and D.W. Greene
Department of Plant and Soil Sciences

Ethephon (Ethrel*) has been used in Washington to increase red color of Delicious apples without reducing the storage life of the fruit through its ripening effect. However, most trials with McIntosh have indicated that increased redness from ethephon is accompanied by stimulated ripening and softening. Nevertheless, the possibility remained that by using very low ethephon concentrations combined with Alar*, red color might be enhanced without significant losses of storage life --- at least for relatively short storage times.

To obtain a clearer picture of the effect of low ethephon concentrations on McIntosh, last year a regional experiment was directed by Dr. G.D. Blanpied at Cornell University. The experiment included orchards in western and central New York (Dr. Blanpied), eastern New York (Dr. C.G. Forshey), Maine (Dr. W.G. Stiles, and Massachusetts. Ethephon was applied at 75 or 150 ppm (1/4 or 1/2 pint/100 gal) 2 weeks before the anticipated middle of the harvest season, in combination with 1000 ppm (1 lb/100 gal) Alar* 2 months before harvest plus a stop-drop spray of either 10 ppm 2,4,5-TP or 20 ppm NAA. (The stop-drop is necessary to counteract the dropping action of ethephon.) Harvested fruits were stored in both regular and CA storage and evaluated for both red color and firmness. In addition, taste panels were asked to distinguish preference or ripeness among the treatments after they had been at room temperature for a week, to see if the treatments would influence marketability of the apples.

The results of the experiment showed that ethephon, whether at 75 or 150 ppm and whether combined with NAA or 2,4,5-TP, increased the red color of the fruit. Thus, low concentrations of ethephon are capable of improving red color of McIntosh throughout the Northeast. (See also the article on ethephon use in July-August, 1974, Fruit Notes.)

Did ethephon at these concentrations stimulate fruit softening? Some small differences were measurable, especially with 150 ppm. Apples that received this dosage were slightly softer than ones that had not received ethephon when they were taken from regular storage in November, and when they were taken from CA in the spring. However, differences were very small. In addition, apples that received only 75 ppm ethephon plus 20 ppm NAA were slightly softer than apples that received only Alar* when fruit were taken from CA in the spring.

What effect did the treatments have on marketability? Taste panels had an extremely difficult time trying to determine prefer-

---
*Trade name

ences or differences in ripening among the samples after storage. When the data from all 5 locations were combined and analyzed, there was no overall difference among the treated samples. This inability of taste panels to consistently distinguish differences among samples is important, for it indicates that low concentrations of ethephon had little or no effect on shelf life or marketability of the fruit.

The conclusion from the study is as follows: Red color of McIntosh apples can be increased without sacrificing fruit condition during and after storage if the following restrictions are met: (1) Alar* is applied 60 days before harvest; (2) ethephon is applied at 75 ppm (1/4 pt/100 gal); (3) 10 ppm of 2,4,5-TP is applied with ethephon, or 10 ppm NAA is applied 3 days after ethephon; (4) apples are harvested within 8 days after ethephon is applied; and (5) temperatures during the period between ethephon application and harvest are not above normal.

It therefore appears that ethephon can be used to improve McIntosh color without stimulating ripening and loss of condition during storage. It should be emphasized, however, that ethephon can tremendously stimulate McIntosh ripening. It must be used with extreme care if apples are to be stored. If the above conditions are met, storage life will likely not be reduced, but to meet these conditions requires great care by the grower plus a large measure of cooperation by the weather. Use ethephon very cautiously on McIntosh.

****

SOIL TREATMENT FOR NEMATODE CONTROL ON STRAWBERRIES

Richard A. Rohde
Department of Plant Pathology

There are probably very few commercial strawberry growers in the state who are without some experience with soil fumigation. This experience may result from personal use, from observation of a neighbor's fields, or from demonstrations by regional specialists or chemical companies. Reactions vary from enthusiastic acceptance to lukewarm skepticism and many feel that it is probably a good idea and "maybe I'll try it next year." If next year is to be that year, now is the time to plan fall soil fumigation in preparation for new beds to be set next spring.

Why fumigate? Fumigation is practiced to control disease organisms in the soil. The main culprit here is the lesion, or meadow nematode, a microscopic worm which burrows through roots, feeding and laying eggs, and, together with several species of fungi, brings about a condition called "black root rot." This disease was in part responsible for the decline of the strawberry industry in the Cape Cod area several years ago and is still apparent through-

out the state. The root-knot nematode species that attacks strawberries in areas south of Massachusetts does not overwinter here and the root-knot species that attacks our carrots will not live on strawberries.

The soil fungi that cause the diseases Red Stele and Verticillium Wilt are not generally controlled by fumigation, although control is possible under some conditions by using large amounts of chemical. Nematode control will often reduce the amount of injury from these fungi that enter the plant through the roots. More commonly, soil fumigation brings about a response spoken of as the "I.G.R." effect. The I.G.R. effect, or Increased Growth Response, is presumed to occur because secondary pests are killed at higher rates of fumigation and plants simply grow more vigorously in their absence.

Should I fumigate? Fumigation is expensive. In most cases, however, a 10-15% increase in yield will make the treatment profitable. Each field has its own set of conditions, and whether or not disease organisms build up to a point where they cause trouble is largely a matter of crop sequence, temperature, moisture, organic matter, and a host of unknowns. Many of these unknowns will also determine whether or not a chemical treatment will work. Poor growth of plants will lead you to suspect a problem, a soil test may confirm that a nematode problem is present, and a trial application of chemical may lead to a better growth.

What can be used? Listed below are fumigants registered for use in Massachusetts. All are liquids that are injected into soil before planting. They become gases that diffuse through all parts of the soil mass. There are a number of factors that can influence their effectiveness: organic matter absorbs these fumes; soil water fills air spaces and prevents their spread: and at low temperatures disease organisms are very resistant to toxic fumes. More than any other group of pesticides, fumigants must be applied precisely according to directions. Unless the soil temperature, texture, moisture, and organic matter are right, and the proper amount of chemical is deposited at the right depth and is sealed in properly, the entire treatment may be useless.

Companies which manufacture soil chemicals can supply detailed information on application equipment. In addition, custom applicators are available who will not only apply treatments, but can give advice based on their rather wide experience.

The chemicals listed below are those generally in use. In addition, your regional specialist can supply you with the names of others that may be of use under special conditions. One of these is DBCP (Nemagon*, Fumazone*), a fumigant which does not injure strawberries at low rates and can be used on growing plants. Methyl bromide mixtures (Dowfume MC-2*, MC-33*, Brozone)*require

*Trade name

an air-tight plastic seal over the field and have not been used extensively because of the expense and need for specialized application equipment.

Chemical (Brand Name)	Remarks
ethylene dibromide (Dowfume W-85*, Dow Ethylene Dibromide*) dichloropropene - dichloropropane mixture (Shell D-D*, Vidden-D*) dichloropropene (Telone*)	Preplant fumigants used primarily for nematode control.
dichloropropene mixture plus methyl isothiocyanate (Vorlex*) dichloropropene mixture plus chloropicrin (DD-Pic*, Vidden DC-15*, Telone C)	Lowest rates recommended by manufacturer give primarily nematode control. Increased dosages give additional soil fungus and weed control.

A final word should be added about the importance of clean plants. It does no good to fumigate soil if disease organisms are immediately added back to the soil with the roots of new plants. The use of healthy-appearing planting stock from a reliabel source is the best insurance against this.

****

CONTROLLING FRUIT FLIES AT ROADSIDE STANDS

G.L. Jensen
Department of Entomology

Adult fruit flies (Drosophila or vinegar flies) are very small (less than 1/8 inch long), have bright red eyes and a tan-colored head and thorax, with a blackish abdomen. They are found everywhere in the world, and are very common wherever fruit and similar materials are permitted to rot and ferment. The entire life cycle of the flies can be completed in as little as 8 to 10 days, hence large populations can build up in only a few weeks.

To control these pests, one should eliminate as much as possible all rotting fruits, vegetables and liquids containing food particles from the premises. The flies can breed in almost anything that contains garbage, even such things as dish water from sinks,

drain water from refrigerators and ice boxes, and floor scrubbings saturated with food particles. In short, practice good sanitation to help eliminate these and other insects.

In food establishments (and roadside markets), fruit flies can be controlled by frequent application of pyrethrum-synergist sprays, fogs or aerosals (the synergist is usually piperonyl butoxide). Frequent applications are necessary inasmuch as these sprays are of necessity very short-lived or non-persistent. Such sprays may be applied directly to the fruits in bags, boxes or bins, since pyrethrum has a low order of toxicity to warm-blooded animals and produces no harmful residues on food crops when used according to the directions on the label.

Outdoors around packing or processing plants, unloading docks, outside walls and other areas where fruits are <u>not</u> present, may be treated shortly before the picking season begins and during shutdowns every 7 to 10 days with Diazinon* - 4 lbs 50% WP per 25 gals of water.

****

ORCHARD MOUSE CONTROL

Edward R. Ladd, Wildlife Biologist
U.S. Fish & Wildlife Service
Hadley, Massachusetts

Control of two native species of mice in orchards is a necessity if fruit growers are to prevent damage to their trees during the winter months. Girdling of tree trunks by meadow mice can occur in a relatively short time and, if severe enough, will cause immediate loss of trees. Damage by these mammals is not restricted to the fall. It can occur, and does, at any time.

A more insidious damage to apple trees is that caused by the pine mouse. This animal is primarily a burrowing rodent. It, too, girdles trees. However, its activity and damage are confined mostly to the root system. Loss of a tree may not be immediate, depending on the severity of the injury. Only a general loss of the tree's vigor or yield may result.

Since an infestation of pine mice may not be readily apparent, orchardists should check blocks of trees periodically. This will make control easier if the locations of this particular species are known. During the growing season, the easiest method for detecting the presence of pine mice is to probe under trees and locate their their subsurface runways. In the fall, just after harvest, probing can be supplemented by searching for mounds of fine soil, pushed up

*Trade name

by the pine mice clearing out their burrow systems.

It is also advantageous to keep an eye on meadow mouse activity. Since the surface runs of these animals may persist for quite some time, it is necessary to determine activity by other signs--such as fresh grass clippings, droppings, and an appearance of runways being used.

Fall control of both species of mice remains the same as in previous years. For meadow mice, reduction of vegetation will help during the growing season by eliminating cover. During the winter, with snow cover, prior vegetative control will have little effect.

For both pine and meadow mouse control, Zinc Phosphide-treated baits still are recommended. Broadcasting these baits (either oats or corn), at the rate of 6-10 pounds per acre, should give adequate control of the meadow mouse.

In the control of pine mice, broadcast baits may only give minimal control. Proper dispersal of bait still requires placing the bait either in the natural travel system by hand baiting or by the use of an artificial trail making machine.

Timing and weather conditions can still be an important factor in control results. Choose a period of the least human activity in the orchard and good, clear weather for applying the bait. This is the period when mice will be most active and most apt to consume the applied baits.

<u>NOTE</u>: As in previous years, before applying any toxic baits, a permit must be obtained for bait application from: Massachusetts Division of Fisheries and Game, 100 Cambridge Street, Boston, Mass. 02202.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914
—
Official Business
Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

BULK THIRD CLASS MAIL PERMIT

Availalbe to the public without regard to race, color or national origin.

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

NOVEMBER–DECEMBER 1974
Vol. 39 (No. 6)

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

NEW ENGLAND FRUIT MEETINGS AND TRADE SHOW

The New England Fruit Meetings and Trade Show will be held at the New Hampshire Highway Hotel, Concord, New Hampshire. The meetings are scheduled for January 8 and 9, 1975.

The hotel is accessible from all major highways. Routes 3 and 93, which lead to Concord, are accessible from anywhere in Massachusetts. Persons coming from Western Massachusetts and Southern Vermont may find the most convenient route to be Routes 9 or 10 to Keene, New Hampshire, and then Routes 9 and US 202, 89 and 93 to the Highway Hotel.

****

APPLE MAGGOT SURVEY (1974)

R.P. Webster and J.G. Stoffolano, Jr.
Department of Entomology

The apple maggot is a major pest of apples, particularly when reduced spray programs are employed and in abandoned orchards which are the breeding ground and probable source of apple maggots for the commercial orchardist. To effectively control the apple maggot in commercial orchards, proper timing of spray programs is essential. This in turn requires methods for monitoring apple maggot emergence and population trends in nearby abandoned orchards. To accomplish this, effective standardized traps are needed to facilitate valid comparisons of apple maggot population trends throughout a given region. A trapping program was conducted during the summer of 1974 involving sampling of 3 abandoned orchards and the university orchard at Belchertown using both the yellow ICY Pherocon traps and 8 cm diameter red spheres. Population trends and trap comparisons were made on both numbers and reproductive condition of the flies captured on the 2 kinds of traps.

The ICY Pherocon trap is a yellow rectangular trap coated with an adhesive attractant consisting of ammonium acetate (50%) and HyCase* (50%). The traps were hung with the adhesive surfaces exposed, on peripheral branches on the south side of the trees. The red sphere is an 8 cm diameter plastic ball with 2 coats of Red Tartar* paint. These traps then were coated with Stikem Special* before being hung on peripheral branches on the south side of the tree.

*Trade name

Four areas were sampled: 3 abandoned orchards and the University orchard. Except in 1 abandoned orchard (Orchard Hill), the traps were set July 1, and examined for apple maggots and rotated weekly between July 15 and October 3, 1974. The traps were replaced approximately once every 3 weeks. The four sampling areas were as follows:

Belchertown. An abandoned orchard sampled with 10 traps (5 red spheres and 5 yellow traps).

University Orchard. The portion sampled in this orchard was under a partial spray program. Six traps were used (3 red spheres and 3 yellow traps).

Shelburne Falls. Five red spheres and 5 yellow traps were used in this abandoned orchard.

Orchard Hill. This abandoned orchard is located on the University of Massachusetts campus. Three red spheres and 3 yellow traps were used, and were checked once a day between August 6 and September 4, 1974.

Data also were obtained from an abandoned block of Yellow Transparent apple trees in Northborough, Massachusetts by Joseph Costante, Regional Fruit Specialist. Vial bait traps were used in Costante's work.

Results. The yellow traps and red spheres appeared to be equally effective in capturing apple maggots (Table 1), though nearly twice as many apple maggots were caught on the red spheres at Orchard Hill. The yellow traps were most effective in capturing females while the red spheres were better at attracting males (Table 1).

Table 1. Number of adult apple maggots caught on yellow traps and red spheres in 4 orchards in 1974.

Sampling area	Yellow Traps			Red Spheres		
	Males	Females	Total	Males	Females	Total
Univ. Orchard	0	1	1	0	0	0
Belchertown	16	82	98	74	21	95
Shelburne Falls	32	180	212	142	66	208
Orchard Hill	7	98	105	112	93	205

The yellow traps tended to attract a larger percentage of newly emerged females (females with undeveloped ovaries) than did the red spheres (Table 2).

Table 2. Development of the ovaries of female apple maggots caught on yellow traps versus red spheres, 1974.

Sampling area	% of females with undeveloped ovaries	
	Yellow Traps	Red Spheres
Belchertown	10	5
Shelburne Falls	16	8

Thus, it may be possible to use yellow traps to predict when flies start emerging in the orchard. However, further work is necessary in orchards comparing the date when the first fly is caught in an emergence cage with the date the first fly is caught on a yellow trap. To be effective for predicting fly emergence, the yellow trap must catch flies within 7 days after emergence. For this reason, emergence cages will be used and an earlier start of the monitoring program will be undertaken during the 1975 growing season.

Seasonal Cycle. The apple maggot population peaked between the first and second week of August at the abandoned orchards in Belchertown and Shelburne Falls (Figure 1). The second peak, around September 18, may have been the result of the greater effectiveness of the new traps that were set out on September 13. The traps that were replaced had been in the orchard about 4 weeks during which there were a number of heavy rains that washed some of the material off the traps, particularly from the red spheres. The survey conducted at Orchard Hill was too short to indicate any long-term trends, furthermore, only one fly was caught. Figure 2 shows the comparison of seasonal cycle between eastern Massachusetts (Northborough) and that of western Massachusetts. Of particular importance are the differences in the population peaks between these 2 areas. At Northborough, the peak occurred between the first and second week of July, while in western Massachusetts, the peak occurred approximately 1 month later, between the first and second week of August. This marked difference was much larger than expected and should be of some significance for apple maggot spray programs. Orchardists in western Massachusetts shouldn't base their spray programs on apple maggot emergence data from eastern Massachusetts without taking into account the possible differences in population trends between the 2 areas.

Many more apple maggots were captured at Northborough than in our study (Figure 2). This difference might be attributed to a larger population of apple maggots as influenced by apple variety at the Northborough orchard. Also, vial traps may be more efficient than the yellow or red sphere traps. This shows the importance of using standardized traps when attempting to make comparisons of trap data between various orchards and regions.

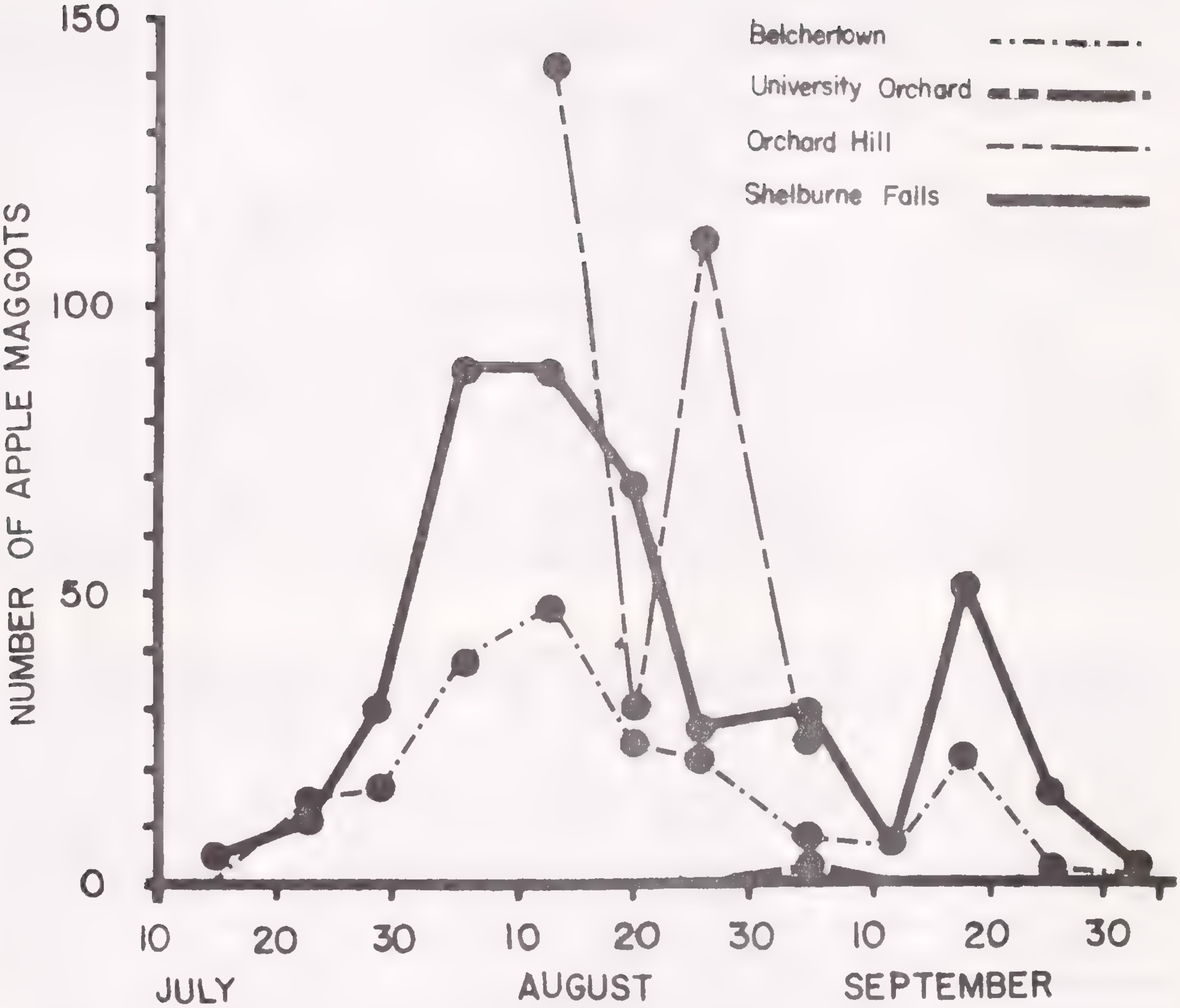


Figure 1. Comparison of total numbers of apple maggot adults captured on traps at the four sampling areas between July 15 and Oct. 3, 1974.

A few points should be made on our observations concerning the effectiveness of the traps over time. The yellow traps attract large numbers of Tachinid flies which clutter the trap to the extent that fewer apple maggots may be caught and those that are caught are more difficult to find. We found this became a problem by the third week. Therefore, the yellow traps should be renewed at least every 3 weeks. Though the red spheres attract fewer num-

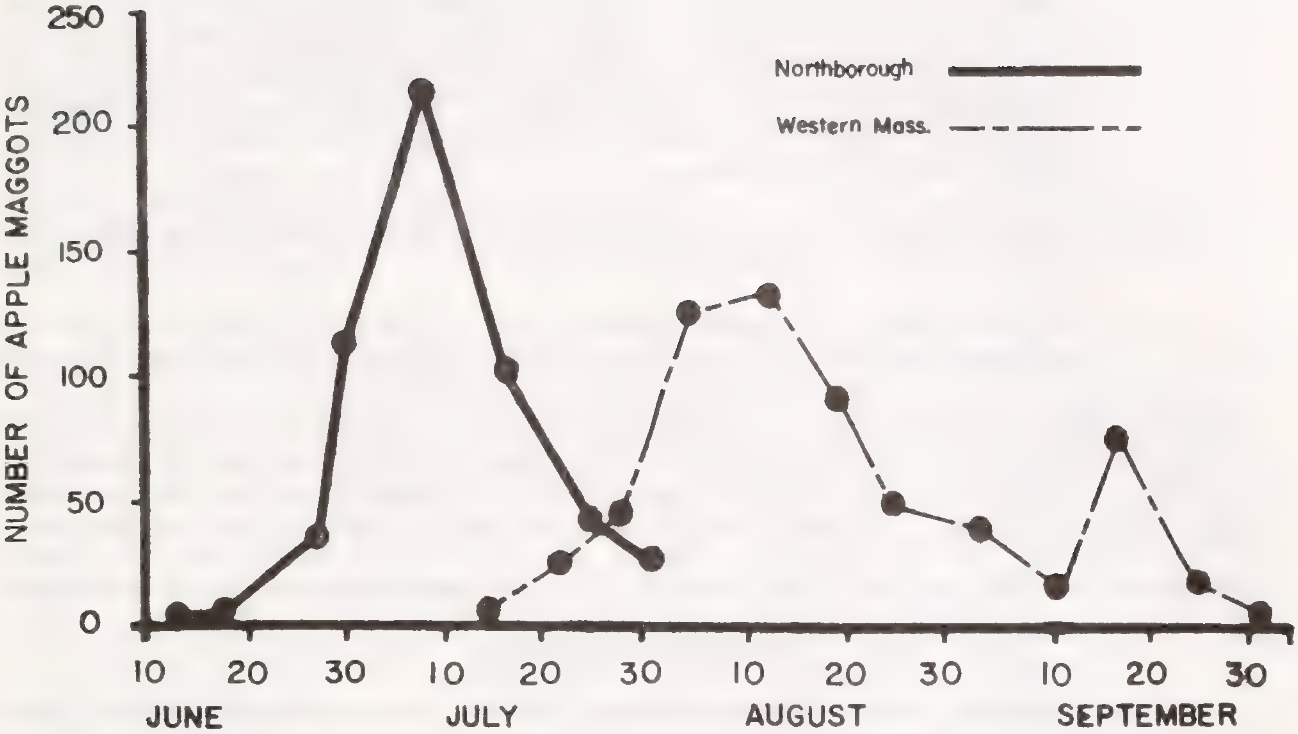


Figure 2. Comparison of numbers of apple maggot adults captured on traps at Northborough (number of adults per trap) and western Massachusetts (total number of adults captured at Shelburne Falls and Belchertown) during trap surveys of 1974.

bers of other species of flies, they begin to lose their effectiveness by the third week mainly because the stikum tends to dry and drip off the bottom of the trap. Heavy rain also removes the stikum to such an extent that the trap may become essentially ineffective. After heavy rain, the red sphere should be checked and replaced if the stikum has washed off. The red spheres should be replaced at least every 2 or 3 weeks.

Summary of Results.

1. The yellow traps and red spheres were equally effective in numbers of apple maggots captured.

2. The yellow traps were more effective in catching females while the red traps were more effective in capturing males.

3. The yellow traps attracted a larger percentage of newly emerged females than did the red traps; thus the yellow trap was more useful in predicting early apple maggot emergence.

4. The apple maggot population peaked between the first and second week of July in eastern Massachusetts while in western Massachusetts, it peaked nearly one month later, between the first and second week of August. Orchardists should be aware of such differences for properly timing their spray programs.

5. Both types of traps should be replaced every 3 weeks or their effectiveness lessens.

6. To make valid comparisons of apple maggot population trends between different regions, standardized traps are required.

Future Work. As a result of these findings, a more intensive study will be conducted next summer comparing trends of eastern Massachusetts to those of western Massachusetts by again using the yellow and red sphere traps. We also will use the vial bait trap to compare efficiency of all 3 traps. Field cages will be utilized in order to compare the yellow trap's ability to capture the first emergents.

Acknowledgments

The authors thank Roger Adams and Dr. Gary Jensen of the Entomology Department for their assistance in locating sampling areas and in conducting the sampling of the orchards. Appreciation is also extended to Joseph Costante, Regional Fruit Specialist, for the use of his data obtained at Northboro.

****

IS CALCIUM DEFICIENCY REDUCING THE STORAGE LIFE OF McINTOSH APPLES?

W.J. Bramlage, Mack Drake, and John H. Baker
Department of Plant and Soil Sciences

In 1972, and again in 1973, we reported results of tests at the Horticultural Research Center, Belchertown, showing that low calcium levels in Baldwin apples were increasing the rates of deterioration of the fruit in storage (Fruit Notes. Nov.-Dec., 1972 and Nov.-Dec. 1973). We continued these tests last year and again found that bitter pit, cork, and decay were reduced as calcium level within the fruit increased, and as we reported in 1973, scald was also reduced at the highest calcium level. We also confirmed the unexpected finding that at very low calcium levels the apples were firmer than at higher levels, despite being larger and deteriorating more rapidly. This firmness apparently reflects an abnormal development of the calcium-deficient apples.

The question most frequently asked us during these years has been: Is calcium level influencing storage life of McIntosh? It is more difficult for us to answer this question for McIntosh than Baldwin, because we do not have a large block of McIntosh trees known to be calcium-deficient, as we do with Baldwin. Nevertheless, we last year conducted a number of calcium experiments on McIntosh trees and fruit, and by compiling all the data, an interesting pattern has consistently emerged: calcium deficiency does seem to exist in McIntosh and it does seem to be influencing storage life of apples.

In September, 1973, we harvested fruit from a block of 10-year-old McIntosh trees at Belchertown that varied in leaf calcium levels. Bushel samples were stored in 32°F air until January. After 1 week at room temperature, these samples were assessed for disorders and some fruit were peeled and analyzed for calcium. The results are in Table 1. The amount of calcium in the flesh of these apples was very low, and the fruit at the highest level had about twice as much calcium as the ones at the lowest level, a surprisingly large range. The apples with more than 0.0150% calcium were almost free of bitter pit and decay, whereas those below 0.0150% had substantial amounts of both disorders.

Table 1. Flesh calcium levels, bitter pit, and decay of McIntosh apples following 4 months storage in 32°F air.

Flesh calcium range (%)	Number of trees	Bitter pit (%)	Decay (%)
.0091 - .0124	18	6	9
.0126 - .0148	15	5	4
.0159 - .0173	3	1	1

In another experiment, McIntosh that had been given postharvest dips in calcium solutions and stored in 32°F air until February were assessed and analyzed as above. The results in Table 2 showed again that above 0.0150%, bitter pit was virtually absent, and also that above this level internal breakdown was reduced to about 50%.

Table 2. Flesh calcium levels, bitter pit, and internal breakdown of McIntosh apples following 5 months storage in 32°F air.

Flesh calcium range (%)	Number of samples	Bitter pit (%)	Internal breakdown (%)
.0107 - .0124	17	7	16
.0126 - .0147	18	10	12
.0153 - .0175	7	0	8
.0177 - .0195	5	1	5

In a third experiment, fruits from limbs with differing yields were stored in 32°F air until March, then assessed and analyzed. The results in Table 3 are based on peel calcium rather than flesh calcium. Since peel calcium is usually about 3 times higher than flesh calcium, the 4 categories in Table 3 are about equivalent to the 4 categories in Table 2. Again we found internal breakdown to occur predominantly (in this case exclusively) in the lowest calcium samples.

Table 3. Peel calcium levels and internal breakdown of McIntosh apples following 6 months storage in 32°F air.

Peel calcium range (%)	Number of samples	Internal breakdown (%)
.0300 - .0399	4	8
.0400 - .0499	15	2
.0500 - .0599	24	0
.0600 - .0773	11	0

All 3 of the experiments suggest that calcium deficiency does exist in our McIntosh trees at the Research Center, and that it is resulting in loss of storage life of our fruit. Analyses of a few samples from some commercial orchards in various parts of Massachusetts resulted in values spanning the ranges shown in Table 3, so the calcium levels in our orchard are not unique. These analyses were associated with the relationship we observed between low calcium levels and "soft McIntosh" reported in a previous Fruit Notes* on that problem in which the very soft fruit had calcium contents that would fall into the lowest 2 categories in Table 3. While all of these pieces of information are incomplete, they all suggest that calcium deficiencies do exist in Massachusetts McIntosh, and that such a deficiency is expressing itself in a reduction of storage life of the fruit.

A recent article by J.L. Mason and J.M. McDougald of the Agriculture Canada Research Station, Summerland, British Columbia (J. Amer. Soc. Hort. Sci. 99:318-321) is pertinent to this question. They grew Spartan trees in nutrient culture at different calcium levels. Apples harvested from these trees were stored in 31°F air for 3 different seasons. The results are summarized in Table 4. The levels of calcium in the fruit flesh obtained at different levels of calcium nutrition correspond closely to the categories we present in Table 2, and as in Table 2, increasing calcium was accompanied by decreasing occurrence of senescent breakdown (internal breakdown). Therefore, the calcium problem appears to extend to the McIntosh-like varieties as well as affecting McIntosh itself. We sampled a limited number of Cortland trees at the Research Center, and found no relationship of calcium level to fruit disorders following storage because very few disorders ap-

*Sept.-Oct., 1974

peared. However, the calcium levels in these samples were all above 0.0175%, and if Cortland is comparable to McIntosh and Spartan, we can see from Tables 2 and 4 that there should not have been much incidence of disorders, as we found there was not.

Table 4. Calcium level and senescent breakdown of Spartan apples stored at 31°F. (From Mason, J.L. and J.M. McDougald. 1974. J. Amer. Soc. Hort. Sci. 99:318-321.)

Flesh calcium content (%), 3-year avg.	Senescent breakdown (%), 3-year avg.
.0131	25
.0139	18
.0150	9
.0178	1

In summary, while we have not conclusively established calcium deficiency in McIntosh apples and its postharvest consequences, a number of observations strongly suggest that calcium deficiency does exist in Massachusetts McIntosh, and that where it does exist it is causing reduced storage life and increased wastage of the apples.

****

FRUIT NOTES INDEX FOR 1974

(This index of major articles has been prepared for those who keep a file of Fruit Notes. The number in parenthesis indicate the pages on which the item appears.)

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

BULK THIRD CLASS MAIL PERMIT

DR. WM. J. LORD FN
PLANT & SOIL SCIENCES
FRENCH HALL

01002

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 40 (No. 1)
JANUARY–FEBRUARY 1975

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

ATTEMPTS TO RAISE THE CALCIUM LEVEL IN APPLES

W.J. Bramlage, Mack Drake, and John H. Baker
Department of Plant and Soil Sciences

It has long been recognized that insufficient calcium can lead to development of cork spot of apples in the orchard, and bitter pit development on the fruit both on the tree and after harvest. Recently, there also has been a rapidly increasing awareness that low calcium levels are contributing to a greater rate of deterioration of apples after harvest, probably through a hastening of the aging processes in the fruit.

With this recognition comes the question of how to raise the calcium level in the fruit. Answering this question has proven to be very difficult. Soil applications have been generally ineffective, because apple roots do not absorb calcium very readily, the tree does not translocate it efficiently, and because it appears that what calcium is available is drawn away from the fruit by the vegetative growth.

Last year, we continued our attempts to raise the calcium level in apples with several new experiments. First, we established an experiment in a block of 40, 10-year-old McIntosh trees at the Horticultural Research Center, in which some trees were mulched with hay (100 lbs/tree) in hopes that reduction of water stress would improve calcium absorption from the soil; other trees were fertilized with calcium nitrate at 5.4 lbs per tree; other trees were sprayed with calcium EDTA at 1 lb per 75 gal on June 18, July 3, and July 16; and still other trees were sprayed with lime-water (10 lbs high calcium hydrated lime per 100 gal) at 2-week intervals from mid-June through late August. At harvest, samples of fruit were stored in regular storage until January, when the apples were evaluated and analyzed for calcium. Neither the calcium nitrate fertilizer nor the calcium EDTA sprays had any effect on the amount of calcium in the apples. Lime-water sprays raised the calcium level significantly and also reduced the amount of bitter pit and internal breakdown that developed during and following storage. Mulching the trees significantly <u>reduced</u> the calcium level of the apples, and there was a strong trend toward <u>increased</u> bitter pit, internal breakdown, and decay in the fruits from these trees. Why? Analyses showed that these fruits were significantly higher in potassium, and it is likely that the hay released large amounts of potassium that interfered with calcium absorption by the tree roots.

This experiment will be continued for a number of years to assess long-range results of the treatments. However, we are replacing calcium EDTA sprays with calcium chloride sprays this year.

Not only was calcium EDTA ineffective but it caused injury to both leaves and fruits. Furthermore, experiments with calcium chloride in other areas and in a commercial orchard suggest that it may be effective in increasing the calcium level.

Another experiment was conducted on a block of mature Baldwin trees, in which some trees received 6 lbs per tree of calcium nitrate fertilizer, others received lime water sprays, and others received a combination of the 2 treatments. As with McIntosh, calcium nitrate fertilizer did not raise calcium, and lime-water sprays did. A combination of the fertilizer and spray treatments was no better than the sprays alone.

It might appear that lime-water sprays are a good way to raise the calcium level of apples. However, it leaves a residue that is extremely persistent, and therefore, cannot be recommended commercially. These experiments add to what has been found before: raising the calcium level of apples on the tree is a very difficult task. We still have no solution to this problem.

In recent years, another approach to the calcium problem has evolved -- the use of postharvest dips in calcium solutions. Last year, we conducted a series of experiments with postharvest calcium dips. We dipped McIntosh, Cortland, and Baldwin apples in solutions of 4% calcium chloride or 2% EDTA with and without a wetting agent. We found that both materials, with or without a wetting agent, raised calcium levels in fruit flesh about 15%, regardless of variety. Furthermore, with Baldwin we also reduced the calcium chloride, to 3, 2, or 1% without causing a difference, and varied calcium EDTA from 4 to 1% without effect. These results are encouraging, for they show that a postharvest dip can raise the calcium level significantly. Nevertheless, the results were not completely satisfactory. The average increase in calcium was not enough to markedly improve storage life of the apples if a serious calcium deficiency exists. Furthermore, the response was not uniform. While the increase averaged 15% regardless of variety and regardless of solution, fruits from some trees absorbed much more calcium that this, while fruits from other trees absorbed much less that this, regardless of the composition of the dip solution.

We feel that there is considerable promise for postharvest dipping of apples in calcium solutions to improve their storage life. However, there is much that we must yet learn about these treatments before we can comfortably recommend them for commercial use. Considerable research is being conducted on this problem throughout the world, and it is hoped that answers to the problems with postharvest calcium dips will rapidly be found. Meanwhile, however, there remains the problem of raising the calcium level in the orchard, where a calcium deficiency produces a separate set of problems. We are continuing to pursue both the preharvest and postharvest calcium problems with extensive series of experiments.

****

VARIETIES OF STRAWBERRIES FOR MASSACHUSETTS

James F. Anderson
Department of Plant and Soil Sciences

Variety	Recommended for	Harvesting Season
Earlidawn	C	Very early
Darrow	T	Early
Sunrise	C	Early
Midland	C & H	Early
Holiday	T	Early-midseason
Surecrop	C	Midseason
Raritan	C & H	Midseason
Midway	C & H	Midseason
Catskill	C & H	Midseason
Redchief	C & H	Midseason
Guardian	C & H	Midseason
Garnet	C & H	Mid-late
Sparkle	C & H	Mid-late
Delite	T	Late
Vesper	C	Very late

T = Trial H = Home garden C = Commercial

Varieties so marked are not necessarily equally adapted to all sections of the state.

Variety Notes

Earlidawn A very early ripening variety. The fruits are of medium size and of fair to good flavor. The plants are productive and of moderate vigor. Earlidawn is recommended where red stele is not a factor.

Darrow This new variety is recommended for trial because of its earliness and resistance to races of red stele. Darrow is intermediate in resistance to Verticillium wilt. The berries are medium to large, firm, glossy and have a good red color. The primary berries tend to be rough. The plants have shown moderate vigor and moderate runner production. Yields in our trials have been fair.

Sunrise This variety is resistant to 3 races of red stele and to Verticillium wilt. The berries are medium in size, glossy bright red, firm and have a symmetrical conic shape. The plants are vigorous, make a good bed and are fair in production.

<u>Midland</u> An early ripening variety with large firm fruit of very good flavor. Midland produces many large, coarse berries and the berries are inclined to be dark in color. Good yields are obtained only with virus-free plants. Midland is not resistant to red stele.

<u>Holiday</u> Produces an attractive, glossy, medium-to-dark-red berry. The berries are large, very firm and have fair to good flavor. The plants are vigorous, make a good bed and are very productive. Holiday shows no resistance to red stele.

<u>Surecrop</u> Recommended largely because of its resistance to several strains of red stele. The fruits are attractive, medium in size and fair to good in flavor. The plants are vigorous and moderately productive.

<u>Midway</u> The fruit is of good size, a deep red color, glossy and very good in flavor. The plants are vigorous, productive and resistant to the common strain of red stele.

<u>Catskill</u> A leading commercial variety with many growers because of its productivity. The berries are large, attractive, have a good strawberry flavor and are good freezers. The berries have a tender surface and rate only fair in firmness. The plants are quite susceptible to leaf spot and require a high level of fertility for best yields. Catskill is resistant to Verticillium wilt but has no resistance to red stele.

<u>Redchief</u> Produces attractive fruit of medium to large size, good red color and high gloss. The berries are firm and have good flavor. The plants are vigorous and make a good matted row. Redchief has been a good producer in our trials. The plants are resistant to 5 races of red stele and have intermediate resistance to Verticillium wilt.

<u>Guardian</u> A sister seedling of Redchief. The berries are large, glossy, and have a light red color. The primary berries tend to be rough. The flesh is firm and has a good strawberry flavor. The plants are vigorous, make a good matted row and the yield was good in our trials. Guardian is resistant to 5 races of red stele and highly resistant to Verticillium wilt.

<u>Garnet</u> The plant is vigorous, forms a full bed and is productive. The berries are large, attractive, moderately firm and have a good flavor. Garnet is not resistant to red stele.

<u>Sparkle</u> One of the important late season varieties. Its outstanding values are productiveness, firmness, good quality and resistance to red stele disease. Berry size is medium to large in early pickings but tends to decline rapidly. It is rated as a good freezer.

<u>Delite</u> A new late ripening variety that is resistant to 5 races of red stele and highly resistant to Verticillium wilt. In our trials, Delite has produced a medium to large, long conic to long wedged-shaped berry. The bright red berries have good gloss, firmness and strawberry flavor. The plants are vigorous and make a good matted row, and have yielded well.

<u>Vesper</u> The plants are large, vigorous and productive. The fruit ripens late, is very large in size, attractive, moderate in firmness and good in flavor. Vesper has prominent protruding seeds. This variety merits trial because of its large size, attractiveness, lateness and productiveness. Vesper is not resistant to red stele.

****

Pomological Paragraph

<u>Use of calcium in the regular spray program</u>. We are anxious to accumulate information for the New England area about the compatibility of calcium chloride ($CaCl_2$) with other pesticides when used in the regular spray program. To do this, we would like to hear from any grower concerning experience with combined $CaCl_2$ and pesticide sprays. At the Horticultural Research Center last year, we used $CaCl_2$ starting with the 5th cover spray in the schedule given below with no adverse effects on McIntosh and Delicious strains. The $CaCl_2$ was dissolved in a bucket of water and added to the nearly filled spray tank. The $CaCl_2$-pesticide spray was applied at 1X because tests in Virginia have shown that for maximum calcium absorption, the sprays should be applied in this dilute form.

<u>Spray Record at H.R.C., Belchertown, starting with 5th Cover, 1974</u>.

Application	Date	Material used and rate per 100 gals	Weather[z]
5th Cover	7/8	Captan-80%, 10 oz Imidan*-50%, 1 lb $CaCl_2$-2 lb[y]	Warm and clear
6th Cover	7/22	Captan-80%, 10 oz Imidan*-50%, 1 lb Omite*-30%, 1-1/2 lb $CaCl_2$-2 lb	Warm and clear

Application	Date	Material used and rate per 100 gals	Weather
7th Cover	8/5	Captan-80%, 10 oz Imidan*-50%, 1 lb $CaCl_2$, 2 lb	Warm and clear
8th Cover	8/19	Captan-80%, 10 oz Zolone*-3EC, 1 pt Plictran-50%, 4 oz $CaCl_2$, 2 lb	Warm and clear

*Trade name
[z]All sprays applied at 6 to 8 A.M.
[y]$CaCl_2$: 77-80% Flake

****

Pomological Paragraphs

Pentachlorophenol-treated posts. Dr. David C. Ferree, Ohio Agricultural Research and Development Center Wooster, Ohio, suggests that pentachlorophenol-treated posts should be well-weathered before being used to support apple trees. When pentachlorophenol was applied 2-4 weeks before setting the posts beside trees, injury and growth retardation occurred, and in some instances, death of the trees. Varieties appeared to differ in their susceptibility to pentachlorophenol. He suggests that treated posts be allowed to weather outdoors for a year before being used to support apple trees. - Fruit Crops Research- 1974., Ohio Agricultural Research and Development Center, Wooster, Ohio.

****

A disorder of Quinte?: In two orchards this past summer, numerous Quinte fruits had purplish blotches on the skin on both the calyx and stem ends of the apple. The nature of the blotches suggested that low calcium was involved with the disorders. However, analyses of a limited number of blotched and non-blotched apples by Dr. Mack Drake showed that the peel calcium was low in both normal and blotched fruit. We would appreciate knowing if blotching of Quinte has been observed by other growers. Also, we have observed that cracking at the stem-end of the fruit appears to be a weakness of Quinte.

****

VARIETIES OF PEARS AND QUINCES FOR MASSACHUSETTS

James F. Anderson
Department of Plant and Soil Sciences

Pear Varieties

Variety	Recommended for	Harvesting Season
Clapp Favorite	C & H	Mid-August
Aurora	T	Late August
Bartlett	C & H	Early September
Gorham	C & H	Mid-September
Seckel	C & H	Mid-September
Flemish	C	Mid-September
Bosc	C & H	Late September
Anjou	C & H	Late September
Dumont	C	Early October

T = Trial   H = Home Garden   C = Commercial

Varieties so marked are not necessarily equally adapted to all sections of the state.

Variety Notes

Clapp Favorite — Fruit greenish yellow with a blushed cheek, good quality, large, attractive, tends to blacken at core when over-ripe, does not keep well. Tree hardy, productive, susceptible to fireblight.

Aurora — A new variety from New York. The fruit is bright yellow, overlaid with a light russet and frequently blushed, pyriform in shape and large in size. This attractive pear has a smooth, melting and juicy flesh of high quality. The tree is vigorous, spreading and not resistant to fireblight. Description based on performance in New York.

Bartlett — Leading commercial pear variety. Fruit yellow, good quality, large size, firm, ships well. Tree medium in size, productive, adapted to wide variety of soils, is susceptible to fireblight.

Gorham — A seedling of Bartlett which it resembles in size and color. Flesh is white, tender, melting and juicy. Holds in storage longer than Bartlett and may be a desirable variety to extend Bartlett season. Said to require a higher level of nutrition than Bartlett to maintain production.

<u>Seckel</u> Fruit bronze color, small, excellent quality, a popular variety for pickling. Tree large, upright-spreading, productive in alternate years, immune to fireblight.

<u>Flemish</u> Fruit large, attractive, excellent quality, highly susceptible to pear scab which can be controlled effectively with modern fungicides. Tree large, vigorous, very productive in alternate years, highly resistant to winter cold.

<u>Bosc</u> Fruit russet, large with long neck, excellent quality when ripened properly, excellent keeper and shipper. Tree medium size, zig-zag growth, productive, tendency to biennial bearing.

<u>Anjou</u> Fruit greenish, large, good quality, good keeper and shipper. Desirable as a late market variety. Trees are large but may lack in vigor and production.

<u>Dumont</u> A late ripening pear of medium to large size and obtuse pyriform shape. The flesh is firm, juicy and the quality is very good. The tree is vigorous and productive.

<u>Quince Varieties</u>

Quince production in Massachusetts is primarily a home garden enterprise although there are a few commercial plantings. This fruit is used entirely for jellies and preserves. Quince trees are notoriously susceptible to fireblight and quince rust. These diseases are not so serious in Massachusetts as to preclude the growing of this fruit provided adequate control measures are employed. Two varieties are propagated by Eastern nurserymen, characteristics of these varieties are as follows:

<u>Orange</u> Fruit roundish, greenish yellow, medium size, flesh pale yellow, tender mild. Ripens in October a few days ahead of Champion. This variety is by far the more popular.

<u>Champion</u> Fruit large, pear shaped, yellowish, with considerable pubescence, flesh pale yellow, firm,slightly astringent, aromatic, mild subacid. Somewhat inferior in quality to Orange.

****

NOTES ON OTHER PEAR VARIETIES

<u>Starkrimson</u> A red bud sport of Clapp Favorite. The fruit is similar in size, shape and quality to Clapp but has a solid red surface color. The fruit was harvested in mid-August in our Amherst orchards and held up well in storage. This variety would add color and interest to a pear display.

<u>Max-Red Bartlett</u> A red bud sport of Bartlett. The fruit is similar to Bartlett in shape, size and quality but has a reddish surface color. We have harvested Max-Red with Bartlett in our plantings.

<u>Dawn</u> A USDA introduction that is harvested in late August or early September at the Horticultural Research Center. The fruit has tended to be larger and more elongate than Bartlett in our trials. This yellow pear has white flesh and fair to good quality. Dawn is not resistant to fireblight and has been a poor producer at the Horticultural Research Center.

<u>Moonglow</u> This USDA introduction was picked in early September at the Horticultural Research Center. Moonglow has a greenish color and is not especially attractive in shape or color under our conditions. The flesh is white and of fair to good quality. Production has been less than satisfactory.

<u>Magness</u> This USDA introduction was harvested the third week of September. This medium-sized, yellow pear is covered with a fine russet. The flesh is soft, fine textured, juicy and of good flavor. Magness has been very slow in coming into production and has yielded poorly at the Horticultural Research Center. This variety is pollen sterile.

****

PUBLICATIONS AVAILABLE

Available from New York State Agricultural Experiment Station, Geneva, New York, is <u>New York's Food and Life Sciences</u> Bulletin No. 41, entitled "Apple Rootstock Problems and Potentials." The authors, J.N. Cummins and Richard N. Norton, prepared this publication to assist the apple grower in anticipating problems that can occur in high density plantings in hopes that growers can avoid them. Problems discussed in the publication include fireblight, "collar rot," Woolly apple aphids, viruses, anchorage, and winter hardiness.

Available from Ohio Agricultural Research and Development Center, Wooster, Ohio, is Research Bulletin 1060, entitled "Insect and Mite Pests of Grapes in Ohio." The illustrations in the publication will help growers identify troublesome insects, and insect damage occurring on grapes.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for private use, $300.

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S. MAIL

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 40 (No. 2)
MARCH/APRIL 1975

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

CAUSES OF PEACH TREE DECLINE

William J. Lord
Department of Plant and Soil Sciences

"Peach tree decline" is a major problem for fruit growers, and also a frustrating problem because its cause is often difficult to diagnose. Factors causing peach decline were discussed in a symposium on peach problems and published in Proceedings of the New York State Horticultural Society, Volume 119, 1974. Some of the pertinent facts presented at the symposium are discussed below.

Factors contributing to peach tree decline in the Hudson Valley. A peach orchard survey conducted in 1973 by Dr. R.C. Pearson, New York State Agricultural Experiment Station, Hudson Valley Laboratory, showed that Valsa Canker (Cytospora Canker) was perhaps the most important problem. It was present on 26% of the trees examined. Five percent of the trees were damaged by peach borer, and only 3% were suspected (though not confirmed) of having X-disease. It had been generally thought that X-disease was the most important problem associated with peach decline, but the survey by Pearson indicates that this may not be true.

Minimizing peach decline. According to Dr. G.H. Oberly, Cornell University, winter injury to the wood which permits penetration of the organism causing canker is perhaps one of the greatest contributing factors in shortening the life of peach trees in New York. Methods of reducing winter injury and Valsa canker are discussed in an accompanying article entitled "Let's Reduce the Damage to Peach Trees from Cytospora Canker."

X-Disease. Research on X-disease has been renewed at a number of Universities and Experiment Stations. Perhaps the most significant finding at present is that the causal organism of X-disease is not a virus but a mycoplasma, an organism which can be controlled by antibiotics. Chemical therapy of X-disease is being researched by Dr. David Sands, Department of Plant Pathology, Connecticut Agricultual Experiment Station, New Haven. In tests of injection methods and antibiotic preparations, Dr. Sands has found that tetracyclines (being used for treating pear decline in California) show promise for the control of X-disease of peach.

Other methods of X-disease control also are under investigation, such as control of the leafhopper vector of the disease and the use of resistant rootstocks such as wild black cherry. Until methods of X-disease control are perfected, growers should renew their efforts at chokecherry eradication. Chokecherries are the main source of inoculum for X-disease and according to Dr. Allen S. Jones, Michigan State University, they should be eradicated from areas bordering

cherry, peach, or nectarine plantings for a distance of 500 feet. Removal to a shorter distance, although not as effective, will be beneficial. Dr. M. Wayne McKee, Hudson Valley Laboratory, stated that preliminary results indicate that spread of X-disease can be reduced to as low as 1% tree loss by eradication of chokecherry and applications of insecticide sprays during September and October to control the leafhopper vector of X-disease. The sprays are essential because the highest populations of leafhopper vectors are present on peach trees in September and October when insecticides are not ordinarily applied.

The peach replant problem. Dr. P.A. Arneson, Extension Pathologist, Cornell University, stated that there is a high rate of mortality of newly-planted peach trees in the Hudson Valley. Examination of these orchards showed that the problem is more related to the "peach replant problem" than X-disease. The young trees often were planted where dead trees had been removed, or else a new planting had been established immediately after removal of old trees. The trees appear weak and many die shortly after planting. The symptoms of the peach replant problem as described by Dr. Arneson are retarded growth, shortened internodes, and reduced yields if the trees come into bearing.

The replant problem is considered a complex of problems with several contributing factors: (1) poor soil structure; (2) low soil fertility; (3) toxic chemicals leached from decomposing peach roots; (4) pathogenic fungi; (5) pathogenic bacteria; (6) stem-pitting virus; and (7) nematodes. One or more of these factors could be the cause of tree mortality and/or low vigor in a peach orchard. The following are suggestions by Dr. Arneson for preventing replant problems.

"In sites where the populations of the root lesion nematode are high, the soil must be fumigated. For proper fumigation, the land must be plowed and fitted to seedbed condition, that is, the soil must be loose and free of large clods to a depth of at least 10 inches. This should be done well in advance of fumigation to allow adequate time for decomposition of the organic matter. Soil temperatures must be above 50°F for proper fumigant action. Therefore, the fumigation should be done from about mid-August to mid-October of the year before the trees are planted. This is to assure adequate time for the fumigant to dissipate before the spring planting.

The newly planted trees cannot be simply ignored until they begin to produce a crop. The first 3 years are the most important ones in the life of a young peach tree. Careful attention to fertilization, ground cover management, pruning, training, and pest control at this time will reap benefits throughout the production life of the orchard."

****

LET'S REDUCE THE DAMAGE TO PEACH TREES FROM CYTOSPORA CANKER[1]

Donald H. Peterson
The Pennsylvania State University

Cytospora canker may be referred to by several different names: Valsa canker, or peach canker, or just plain canker, or gummosis, or perennial canker. These cankers occur on twigs, branches, and scaffold limbs, in the crotch area and on the trunk, and at pruning cuts. The disease occurs on all stone fruit trees, but seems to cause the most concern on peaches and nectarines. During and after rains and periods of high humidity, gum oozes in the area of the canker. When it dries, it turns black and hard.

Smooth sections of the bark in the cankered areas become peppered with the pimple-like fruiting bodies of the causal fungi. During rainy periods, these pimples ooze a white to orange miniature toothpaste-like mass of spores. These can be splashed by rain or, when dry, be blown by wind. Spore production can occur anytime the temperatures are above freezing. However, the disease is usually not initiated when the trees are growing vigorously. Most infections take place during the fall, early spring, and during winter when temperatures are above freezing.

The organism causing Cytospora canker cannot penetrate healthy bark or buds. It must have injured areas of some kind. The injured areas most frequently entered are: (1) dead dormant buds; (2)cold-injured wood; (3) pruning cuts, particularly those made when the trees are dormant; (4) pruning stubs, which often die back to their main branch; and (5) brown rot cankers.

None of the stone fruit species are immune to Cytospora canker. Chemical treatments alone are not very effective. Thus we need to "learn to live with Cytospora canker." This can be done quite successfully by your management practices. Let's begin with the new orchard you are planning.

<u>Setting a new orchard</u>.

1. Your site should not be one with poor internal soil drainage. Wet spots need to be drained or avoided. Trees on these sites often suffer cold damage and have a considerable amount of dead wood in them. The more dead wood in trees, the more likelihood of places for Cytospora to get started.

2. New orchards should not be planted near cankered, older ones, and especially not downwind from them. It is nearly impossible to protect the new planting from the vast number of spores coming from the older cankered trees. Let me give you an example.

---

[1] This article appeared in The Maryland Fruit Grower, Vol. 44 (No. 2) 1974

Two orchards of 156 trees in each were planted. One was next to an older, diseased planting - the other one-third mile away. Everything was done alike to both orchards. At the end of 5 years, there were 808 cankers in the more distant planting. The obvious lesson is not to place young trees next to older, diseased ones. Interplanting in peach and nectarine orchards older than 5 years of age is of questionable value. These interplants have little chance of a productive, canker-free life. It is far better to push out all the old trees and start over with all young trees. If the planting cannot be separated from an older, diseased one, at least try to establish it on the upwind side of the older trees.

3. Select varieties that are winter bud-hardy. Dead buds offer an excellent spot for the Cytospora canker organism to get into the tree. When it does, it becomes quite efficient in producing spores on twigs it kills. I like to use Redhaven as a standard to approach or exceed in choosing varieties for dormant bud-hardiness. For most of you this means not selecting Jerseyqueen or Washington, which otherwise may be quite desirable. If you need help in identifying winter bud-hardy peaches and nectarines, talk with your state university people. You might be interested in a listing Dr. Marshall Ritter, Dept. of Horticulture, Penn. State Univ., University Park, Pa., and I have prepared called "Peach Varieties for the Seventies." You may want to establish a trial planting of some of the named varieties from Harrow, Canada. These can be identified by the "h-a-r" at the beginning of their name: Harbinger, Harbrite, Harmony, etc.

4. Attempting to transplant and train large-sized nursery trees often results in canker at an early age. Those 7/16 to 9/16 caliper, 2 to 3-1/2 feet high, I believe are the ideal size to transplant and train.

Training young trees.

All too frequently, trees received from the nursery are planted, then headed-back somewhere to a point between the knee and the belt, and left to shift for themselves. This seems especially true of replants. In Michigan, a cultural management survey was made of 42 orchards. The one management practice most often associated with winter injury and canker was poor training of the young trees. Trees that were allowed to develop close, narrow crotches or those that had received no training, were often broken down or dead at an early age. Only 20 percent or less of the trees in these 42 orchards had moderate to good crotches.

Whether you choose an open-vase or some type of central leader system for you tree form, begin the training that first year.

Otherwise, the trees will end up with narrow crotches that are susceptible to winter injury, to the Cytospora canker disease, and to limb breakage. Whatever system you choose, don't remove more than one-fourth of the top when making those first cuts. I personally like a modified central leader tree form, because of the ease in selecting wide-angle limbs, less winter injury, and less places for injured or dead wood in which the canker disease can become established.

Pruning

Pruning is one of the essential practices in an orchard, and consequently it represents a type of injury that cannot be prevented. The tree can heal its wounds only during the growing season. So pruning wounds made during late fall or winter remain open doors for the Cytospora organism as they do not heal until spring. Half of the trees of 4 varieties were pruned before mid-February and the other half at the time of bud-swell. One thousand pruning cuts were marked in each half for later examination. At shuck fall, 50 of the 1000 cuts made during the winter had canker started in them. None of the cuts made just before bloom were infected. These results stress the importance of delaying pruning until spring, but I shall suggest other reasons as well.

There is no doubt in my mind that winter-injured tissues are the major point of entry for the Cytospora organism. These injured tissues can be buds, branches, areas on the scaffold limbs and trunks, and crotches. Narrow crotches lack winter hardiness just as do the buds of some varieties. Beyond that, pruning always results in a decrease in the ability of peach and nectarine trees to tolerate a rapid drop in temperature to below freezing and to low temperatures. Spring pruning prevents this hazard. Keep in mind the best day to prune a stone fruit tree is the day it is in full bloom. Delaying pruning until near bud swell will reduce the risk of winter injury to buds and shoots and after bud swell, the growing tree is more resistant to the disease even though the fungus may penetrate the bark or pruning cuts. Quite a number of growers are finding the heading back of new growth in early to mid-July with a sicklebar mower a valuable practice. A good bit of the toal pruning needed is done very rapidly by flat-topping the trees just above the crop. Cuts are made at a time when they heal rapidly. Since some of the pruning is done, the remainder might be delayed a bit longer the following spring. The practice does aid in coloring the fruit but it will also concentrate fruit ripening.

Pruning stubs of limbs an inch or more in diameter are favorite places for Cytospora canker. This is especially true of cuts made during the dormant season. Three practices will aid in reducing the number of infected cuts: (1) Wait until bud-swell or later to make the cuts. (2) Do not leave stubs; rather make the cut as close to the next branch as possible. (3) Apply a fungicide spray before the first rain following spring pruning. The materials do not seem

to be as important as getting the job done. Sulfurs, dichlone, captan, ferbam and benomyl all appear effective.

Other management practices and Cytospora canker.

1. Winter injury. We have discussed orchard sites, selection of varieties, tree training and pruning as they relate to winter injury. Fluctuating winter temperatures can result in injury to the bark of trunks, crotches and scaffold limbs. The dark-colored bark absorbs the sun's energy. On quiet, sunny winter days, the temperature under the bark on the sun-side of the trees will rise 30 degrees or more above the air temperature. Then the rapid cooling to below freezing after sunset sets up conditions for winter injury. Coating the trunks, crotches and lower portions of scaffold limbs with a white water-emulsion paint will moderate the temperature extremes under the bark and reduce winter-injured areas.

2. Brown rot cankers from blossom blight and fruit rot are entry points for the Cytospora fungi.

In summary, I wish to stress the following points:

1. Do not plant young peach trees near older, diseased stone fruit trees.

2. Begin tree training the first growing season and strive for wide-angled crotches in whatever training system you use.

3. Provide adequate fertilization for good tree growth, but avoid excessive nitrogen and late cultivations.

4. Follow a good brown rot control program.

5. Remove all fruit from the trees following last picking to prevent brown rot cankers.

6. When pruning, make all cuts clean and close to the next larger branch.

7. Delay pruning until bud swell and follow the pruning before the next rain with an effective fungicide. Try some summer mowing.

With these measures, you are not likely to clean up trees already severely diseased. You will be able to prevent many new infections and add years to the life span of young orchards.

****

EFFECT OF NITROGEN AND POTASSIUM FERTILIZER ON COLOR, RUSSET AND CORK SPOT OF GOLDEN DELICIOUS APPLES

Mack Drake, John H. Baker, W.J. Lord
Department of Plant and Soil Sciences

In a recent article, (Journal of the American Society for Horticultural Science 99:144-145, 1974) M.W. Williams and H.D. Billingsley reported effects of N fertilizer on yield, size and color of Golden Delicious apples grown in Washington. They found that fruit color and quality of Golden Delicious apples was directly related to leaf N content. The correlation coefficient between leaf nitrogen and extra fancy yellow fruit was -0.89, which means that as N level increased, packout of extra fancy yellow fruit decreased. When leaf-N was above 2.2%, the fruit tended to be large and green. Trees with light green foliage, indicating low to intermediate leaf-N, always produced yellow fruit. Maximum yields of high-quality fruit were obtained when leaf-N levels were from 1.9 to 2.1%.

Working cooperatively with Davis Orchard, Bolton, Massachusetts, we are studying the effects of 3 levels of N and 3 levels of K fertilizer on the color and russet condition of Golden Delicious apples. During the past 5 years, levels of approximately 1.95, 2.10 and 2.20% leaf-N have produced decreasing quantities of yellow fruit as leaf-N has increased. This is in close agreement with the results reported above by Williams and Billingsley.

In addition, we have found that russet increased as leaf-N increased, but decreased as leaf-K increased. The data in Table 1, obtained in 1973, illustrate this relationship and are typical of those for 1969-72.

Effects of leaf-N and K on color and russet of Golden Delicious, 1973. Davis Orchard, Bolton, Massachusetts.

Leaf-N (%)	Yellow color (%)	Russet (%)
2.00	82	63
2.15	70	67
2.20	62	86
Leaf-K (%)		
1.60	74	77
1.75	70	75
1.90	69	66

Under Massachusetts conditions, we recommend that Golden Delicious be maintained in the range of 1.9 to 2.0% leaf N and 1.8% leaf K.

INFLUENCE OF LIME, SOURCE OF NITROGEN, AND/OR TIME OF APPLICATION ON VEGETATIVE GROWTH AND FRUIT OF STURDY SPUR DELICIOUS

W.J. Lord and John Baker
Department of Plant and Soil Sciences

For years, we told growers that the amount of nitrogen applied, not the source, was the most important consideration in growing apples. However, it is now known that bitter pit, cork spot, watercore, internal breakdown, storage rots, etc. are all reduced in severity if calcium (Ca) is present in high enough concentrations in fruit. At our New England Fruit Meetings in 1972, Dr. Miklos Faust, USDA, reported that ammonium N reduces both leaf and fruit Ca more than does nitrate N. He suggested that if ammonium nitrate is used, it should be applied early enough so that all ammonia is converted to nitrate before bloom. Furthermore, Faust suggested correcting soil pH, applying Ca to the soil, and using Ca sprays to help reduce the problems associated with low calcium. More recently, it was suggested and later stated in the "Report of Northeast Fruit Research Task Force" (June 1973) that "N nutrition should be reviewed. The source of N, whether nitrate or ammonia, may make a difference in growth, hardiness, flowering and fruit quality." To investigate the influence of a high soil pH, liming, N source and time of N application on vegetative growth and fruit of Sturdy Spur Delicious, an experiment was initiated in 1972 at the Horticultural Research Center.

The Delicious trees were planted in a soil having a pH of 6.5-7.0 to a 2 foot depth. Two and one-half lbs of high Ca lime (40% CaO; 7% MgO) were mixed in the soil in the planting holes for half the trees. Ammonium nitrate, calcium nitrate or potassium nitrate was then applied annually either 1 month before bloom or at bloom.

Results. Leaf analyses to date show that N source had no influence on N and Ca content of leaves (Table 1). Although muriate of potash was applied under the trees receiving ammonium nitrate and calcium nitrate in amounts to equal the potassium (K) content of potassium nitrate, differences in K levels were apparent in 1973. Leaf K was higher in the trees receiving ammonium nitrate plus muriate of potash than in those receiving just potassium nitrate.

Time of N application (a month prior to bloom or at bloom) did not influence the N, Ca, K or Mg levels in the leaves. Of interest is that the economical procedure of incorporating high calcium lime with the soil in the planting hole, significantly increased Ca content in 1972 and 1973 although the differences were small: 1.08 and 0.79% Ca in leaves of trees from limed soil in 1972 and 1973, respectively, as compared to 0.96 and 0.74% Ca in leaves from the trees in non-limed soil.

Conclusion. Mixing lime with the soil used in the planting hole for apple trees enhanced Ca levels for 2 years. Although the pH of this soil was high and/or lime was incorporated in the soil, leaf Ca was still relatively low, further emphasing the difficulty of increasing the amount of this element in apple trees.

The effect of soil applications of 3 sources of nitrogen on leaf nitrogen (N), potassium (K), calcium (Ca) and magnesium (Mg) of Sturdy Spur Delicious trees.

Year	Treatment	Element (% of the dried weight)			
		N	K	Ca	Mg
1972	Potassium nitrate	2.32a[z]	0.98a	0.97a	0.40a
	Ammonium nitrate	2.34a	1.01a	1.02a	0.39a
	Calcium nitrate	2.33a	0.93a	1.07a	0.41a
1973	Potassium nitrate	2.48a	1.63b	0.74a	0.26a
	Ammonium nitrate	2.49a	1.76a	0.79a	0.25ab
	Calcium nitrate	2.52a	1.71ab	0.77a	0.24b

[z]Means for an individual year, within a column, followed by a different letter are significantly different at the 5% level.

****

POMOLOGICAL PARAGRAPH

Elimination of Sod with Herbicides. At our New England Fruit Meetings, the panel on size-control rootstocks expressed concern about complete elimination of sod under fruit trees with herbicides. With no snow cover, a soil free of grass and weeds might expose fruit trees to a deep soil freeze and root injury. Our experience using paraquat plus simazine, dalapon alone or in combination with simazine has shown that complete control of perennial grasses and broadleaf weeds is unlikely when herbicides are applied at recommended rates. In addition, annual grassy and broadleaf weeds generally invade the herbicide-treated areas, and by late summer the weed population frequently is as dense as under trees that had been cultivated until early July. At our Horticultural Research Center, when we purposely applied excessive amounts of herbicides, not only was the soil free of weeds, but soil erosion occurred which exposed tree roots. Under these conditions, increased winter injury might well occur.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 40 (No. 3)
MAY-JUNE 1975

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

PROGRAM PLANNING FOR NEW ENGLAND FRUIT MEETINGS

As in previous years, the Program Planning Committee for the New England Fruit Meetings will be held in mid-June. Each New England State is represented on the committee by its Fruit Extension Specialist and President of the Pomological or Horticultural Society. The committee members would appreciate suggestions for speakers and/or topics for 1975 meetings.

****

LEARNING FROM THE DUTCH

William J. Lord
Department of Plant and Soil Sciences

The University of Massachusetts granted me a sabbatical leave from February 1, to July 15, 1975, to study designs and training systems for intensive orchards. Since many of the concepts and techniques used in intensive orchards were originated or "refined" by the Dutch, it seemed most logical to make my headquarters in this country.

I am at the Wilhelminadorp Research Station located in a major fruit growing area of the Netherlands. The research station bears the name of the polder[1] on which it is located. The Wilhelminadorp polder is a 10,000 acre company-owned farm, one of the largest, if not the largest, in the Netherlands. Arable crops are grown on this farm with the exception of the research orchards and those of the company. The polder is near the city of Goes and a part of the Zeeland Province. Zeeland includes a small part of the continent and 6 islands jutting into an estuary of the North Sea.

Wilhelminadorp was established as an experimental garden in 1902. In 1940, laboratories for entomology, plant pathology and soil science were added. In 1954, it became the Fruit Research Station for the Netherlands. The station conducts applied research in all fields of fruit growing, i.e. pomology, pathology, entomology, soil fertility, physiology and economics, both for tree and small fruits. The research on small fruit is conducted in an Experimental Garden at Kapelle, 4 miles from Wilhelminadorp. There are 50 research acres at Wilhelminadorp and a professional staff of 10, including the Director, plus 27 assistants. Ir. R.K. Elema is director of the station and at the same time the National Fruit Advisor. The National Fruit Advisor is responsible for the coordination and the technical content of extension recommendations.

The Pomology section, to which I am attached, has a professional staff of 3. Dr. S.J. Wertheim, Head, Dr. H.J. van Oosten, and Ing. P.D. Goddrie. Dr. Wertheim's fields of specialty are planting systems, pollination, pruning, and growth regulators. Incidentally, Dr. Wertheim presented 2 talks on the Dutch Fruit Industry at the Dwarf Fruit Tree Meetings at Grand Rapids, Michigan in March, 1973. Dr. van Oosten's specialties are virology, clones, rootstocks, and interstems, and Ing. Goddrie does variety testing. The small fruit section is staffed with a professional and one assistant.

Seven Experimental Fruit Gardens are located in the important apple and pear districts in the Netherlands and are financed by the government and growers on a 50-50 basis. The researchers from Wilhelminadorp and the Extension Service in the area where the Experimental Gardens are located establish research and demonstration plots at these locations.

I plan to report in Fruit Notes on the fruit industry in the Netherlands and its trends, and on research developments. The first of several articles appears below in which the statistics of the fruit industry are summarized with major emphasis on apples.

---

[1]The reclaimed land surrounded by dikes is a polder. Each polder has a name. A polder may be small in area or over 100,000 acres in size, such as the North-east polder.

****

NETHERLANDS AND ITS FRUIT INDUSTRY

William J. Lord
Department of Plant and Soil Sciences

Over 13.5 million people live in the Netherlands, a country about 1/3 larger than Massachusetts. Population density is nearly 1000 per square mile, but in the western part of the country it is nearly 8 times as high. An area about the same size as Greater London, which includes the cities of Dordrecht, Rotterdam, Delft, the Hague, Leiden. Haarleem, Amsterdam, Hilversum, and Utrecht, has a population of about 5 million.

The Netherlands has an oceanic climate with no hot summers or cold winters and little snow. It is situated 52° north latitude and therefore the light intensity is low; hence the interest in small fruit trees which utilize light more efficiently than large trees.

The land is flat, half of which has been taken from the sea. The marine and river clay soils on which most orchards are found have a high clay and silt content. They are frequently shallow but the combination of rich soil, humid climate, and a high water table produces vigorous tree growth unless controlled both by dwarfing rootstocks and pruning.

Major fruit crops. The acreage of major fruit crops is shown in Table 1. It can be noted that the acreage has decreased since 1950. However, the decrease in strawberry acreage has been less dramatic because of a surge in planting during the 1950's.

In 1969, there were 2688 tree fruit holdings of 12.5 acres or more (Table 2). Orcharding is less specialized than in Massachusetts and many of the orchardists produce sizeable tonnage of each major tree fruit. This means that the acreage of either apple, pear, plum of cherry on a fruit farm may be quite small by our standards.

Table 1. Average trend of fruit crops in the Netherlands.[1]

Fruit crop	Year 1950	1960	1970[2]	1974[2]
Apple	101,530	88,998	65,410	54,770
Pear	36,328	27,083	20,888	17,785
Plum	13,408	6,005	3,410	2,770
Cherry	12,973	8,433	4,638	3,313
Strawberry	8,958	12,208	6,728	6,083
Raspberry	2,438	3,298	985	638
Red currant	4,480	3,935	1,235	710
Black currant	4,100	3,595	405	160

[1]Source: Netherlands Central Bureau of Statistics.
[2]Reporting of small holdings discontinued but total acreage involved is small.

Table 2. Number of tree fruit holdings and acreage by size in 1969.[1]

Orchard size (acres)	No. of holdings	No. of acres
12.5 - 15	626	8,358
15 - 17.5	510	8,085
17.5 - 20	372	6,815
20 - 22.5	269	5,598
22.5 - 25	199	4,658
25 - 37.5	426	14,148
37.5 - 50	127	5,400
50 or more	99	7,385
	2,628	60,447

[1]Source: Netherlands Central Bureau of Statistics.

The number of holdings greater than 12.5 acres increased during the 1960's but probably are on the decrease now. Basically, there are 4 reasons for the decreasing acreage and size of holdings in tree fruit: the Eurpoean Economic Community (EEC), increased production in other European countries, rising costs, and intensification.

The EEC's Common Agricultural Policy established in 1967, eliminated the trade barriers for apples and pears within the Community. As a result, the Dutch apple and pear market became exposed to the EEC's oversupply caused by extensive plantings during the 1960's of apples in France and pears in Italy. The problem of oversupply is further intensified by the "bumper" crop years in Germany, the principal market for Dutch apples. The "bumper" crops are primarily due to the biennial nature of numerous small holdings of obsolete

trees that receive little or no care. Until the extensive apple plantings came into production, the German apple buyer bought at the fruit auctions in the Netherlands. They like the system because it is competitive buying. If the German buyers bought in France from one of the cooperatives, they did not know at the time whether apples could have been bought for less money at another cooperative. The advantage of the Dutch auction system is less now because the German buyer can obtain large quantities of apples uniformly packed from a cooperative in France. At the Dutch apple auction, small lots of grower-packed apples predominate. Naturally, fruit quality varies considerably among lots.

Growing and marketing costs rose rapidly in the 1960's. Consequently, beginning in 1967, the Dutch apple and pear grower was faced with low prices for his product due to oversupply and rising costs. Acreage decreased, a subsidized tree removal program was initiated, and intensification was started to increase yields per acre and production per man hour. The large grower suffered most because of high labor costs; thus the trend to smaller holdings. It now is believed that the most economical unit is the family orchard with no hired labor except harvest help. In terms of acreage, some individuals believe that 15 to 20 acres constitutes an economical unit for one man when tree fruits are the only source of income.

Apple production. Table 3 shows the trend by variety. Apple production increased during the 1960's and in 1971 the Dutch apple growers marketed the biggest apple crop ever (about 28.7 million 40-lb bushels). This amount may never again be reached.

Table 3. Apple production by variety in the Netherlands (thousands of metric tons marketed).[1,2]

Variety	Year				
	1965	1969	1971	1973	1974[3]
G. Delicious	63	140	188	168	160
Cox's Orange	37	78	88	81	58
Belle de Boskoop	67	72	85	66	44
James Grieve	30	38	38	36	32
Jonathan	45	38	26	13	12
Stark Earliest	8	7			
Lombartscalville	8	11			
Y. Transparent	10	7			
Laxton's Superb	5	5			
Winston		5			
Tydeman's Early		3			
Benoni		3			
Others	85	68	95	86	79
Total Marketed Production	358	475	520	450	385

[1] Metric ton = 2204.6 lbs.
[2] Source: Netherlands Central Bureau of Statistics.
[3] Forecasted marketed production.

The industry is geared to the fresh market, thus varieties with good eating and/or cooking qualities are preferred (Red Delicious are considered too sweet and McIntosh lacking in flavor and texture.)

The Golden Delicious became the major variety during the 1960's, which is unfortunate because much of the EEC oversupply of apples is of this variety. The production of Cox's Orange, a high quality eating apple, increased, whereas Belle de Boskoop[1] and James Grieve production has been stable. The popularity of Jonathan with the grower has declined rapidly since 1965.

The Benoni variety may be of interest to the Massachusetts apple grower since it originated in Dedham around 1830. This is an early variety, by Dutch standards, ripening in late-August to early September. Benoni is strongly biennial and requires chemical thinning to insure the harvest of marketable-sized apples and repeat bloom. At present ethephon is the best thinning compound for Benoni. It is applied in early bloom at 960 ppm on young trees and 1920 ppm on older trees.

Pear industry. This industry is small in comparison to the apple industry, with Conference being the leading variety (Table 4).

Table 4. Pear production in the Netherlands (thousands of metric tons marketed)[1,2]

Variety	Year				
	1965	1969	1971	1973	1974[3]
Conference	17	21	32	18	36
Legipont	9	12	9	6	11
Doyenne du Comice	3	5	12	6	17
Beurre Hardy	2	7	8	2	19
Clapp's Favorite	8	10	9	3	5
Bonne Louise d'Avranches	7	7	8	3	12
Triomphe de Vienne	2	8			
Precoce de Trevoux	4	6			
Beurre Alexandre Lucas	1	3			
Others	26	11	32	17	29
Total Marketed Production	79	90	110	55	129

[1]Metric ton = 2204.6 lbs.
[2]Source: Netherlands Central Bureau of Statistics.
[3]Forecasted marketed production.

Pear production fluctuates considerably, as illustrated by the production figures for 1973 and 1974, and in heavy crop years the supply exceeds the demand. Much of the biennial bearing is due to unfavorable weather for pollination. Fortunately, weather is generally more favorable for pollination of apple trees because they bloom later. At present (March 10) a small pear crop appears pos-

sible this year due to the large crop in 1974 and in part to the advancement of flower development by the unusually warm weather.

[1] I will refer frequently to Boskoop in other articles concerning planting systems and pruning because trees of this variety have McIntosh vigor. The fruit are large, green and russetted. I rate the fruit good for flavor and texture.

****

MUMMY BERRY DISEASE OF BLUEBERRY

C.J. Gilgut
Department of Plant Pathology

One of the most destructive diseases of highbush blueberries in Massachusetts is mummy berry, caused by a fungus with the awesome name, *Monilinia vaccinii corymbosi*. It does not occur every year and several years may pass without the disease.

The fungus winters over in the diseased fruit, called mummies, which drop to the ground during the growing season. The mummies are hard, dry, pumpkin-shaped, dark grey bodies and, when moist, swell to twice their size and are black. They are very resistant to cold, heat, and drought and may lie dormant on or in the soil under the plants for more than one season.

When weather is wet in spring, about the time buds swell and growth starts on the plants, the mummies produce brown, moist, cup-shaped or funnel-shaped "mummy cups," 1/4 to 1/2 inch in diameter. Clouds of dust-like spores called *ascospores*, are discharged from the cups over a period of time - usually between mid-April and the end of May. Spores that land on swelling buds and new growth attack the new shoots causing a twig blight, spur blight and dieback which often is confused with late frost injury. Later, the dieback may extend down the stem and kill it, sometimes even to the ground. The fungus also attacks the blossom clusters to produce a blossom blight. If moist conditions continue during the spring and especially during bloom, the spread of the disease is rapid and the loss may be serious.

In about 10 days to two weeks after infection, there develops a greyish or brownish fuzz on the diseased shoots, spurs, and flower clusters and the fuzz produces an abundance of secondary spores, different from those produced by the mummy cups, which are called *conidia*. It is the conidia that invade the green berries in wet weather. The fungus continues to grow inside the berries as they enlarge and causes them to turn salmon-colored and dry and hard as

they approach ripening. They drop to the ground before the healthy berries are ripe and the skin sloughs off leaving the hard fungus mass which dries and hardens into the mummy which winters over. The cycle is repeated the following spring.

Control. No control is needed if weather is dry from the time buds begin to swell until "flowers" drop because the disease is not likely to be serious.

But if weather is wet during this time, some cultural practices and a spray program will be helpful in reducing the loss of fruit.

1. Keep the diseased plants and plant parts removed from the planting and remove wild or neglected blueberry bushes around the borders outside of the planting. Such plants often harbour diseases and are a source of infection in the planting. They make disease control in the planting difficult.

2. Rake or hoe under the plants to disturb the mummies or sweep them into the rows where they can be cultivated. Disturbing the soil about one inch deep is enough.

Mummies that are disturbed frequently, so that contact with the soil is broken, do not produce mummy cups and mummy cups broken from mummies do not produce spores. Disturbing mummies should be done several times at weekly intervals during the time they form mummy cups usually from about April 15 to about the end of May, depending on the season. It is practical only when the planting is in clean cultivation and not in sod culture.

3. Spraying - Do not expect complete control. In carefully controlled experiments carried on for several years, research workers could get only 50 to 60% reduction in mummy berry. Ferbam was more effective than other spray materials tested.

Use ferbam for the first few sprays at 2 to 3 lbs in 100 gallons of water and apply to "drip-off." Time the applications long enough before rains so they dry on and will be there to give protection during the rain. Applications after rains are usually too late to prevent the disease from entering the berries and will not eradicate it from inside the berries.

Make the first application of ferbam about May first and repeat in 7 days if weather is wet, otherwise in 10 days. Repeat again in 7 to 10 days. The Environmental Protection Agency does not allow ferbam on blueberries closer to harvest than 40 days. For this reason, after May 15 or 20, use captan at 2 lbs in 100 gallons of water at 7 to 10 day intervals until harvest time. Captan is allowed during harvest and on the day of harvest. These late sprays will help reduce the amount of brown fruit rot during harvest and post-harvest fruit rot.

****

CONTROLLING WEEDS IN STRAWBERRIES WITH HERBICIDES

Dominic A. Marini
Regional Fruit and Vegetable Specialist

Since strawberries occupy the soil for more than a year from planting to harvest, control of weeds is a major production problem. Herbicides, properly used, can reduce the problem considerably but not entirely. Some cultivation is necessary for loosening the soil to enhance the rooting of runners, and to eliminate weeds not controlled by herbicides.

In Massachusetts, herbicides that have been found effective for use on strawberries are chloroxuron (Norex* or Tenoran*), Dacthal* and diphenamid (Dymid* or Enide*). Dacthal* and diphenamid are pre-emergence materials and must be applied to weed-free soil before weeds appear; they do not control weeds that have emerged. Chloroxuron can be applied either pre-emergence or early post-emergence before weeds reach two inches in height. Best results are obtained when herbicides are uniformly applied to moist, smooth, clod-free soil followed by one-half to one inch of rain or irrigation within one week.

Dacthal* may be pre-plant incorporated -- apply and work it into the soil shallowly with a disc harrow or weeder before setting plants. Or, it may be applied immediately after transplanting. It is effective for about 6 weeks and controls annual grasses and most broadleaf weeds except ragweed, smartweed and Galinsoga. It may also be applied late in the season for fall and winter weeds.

Diphenamid should not be applied on new beds until plants are established, and it may not be applied again for 6 months. It is effective for about 8 weeks and controls annual grasses and broadleaf weeds except Galinsoga. It is not recommended for use on the Raritan variety since injury may occur.

Chloroxuron should not be applied until plants are established and not more than twice in one season. It is effective for about 8 weeks. Most broadleaf weeds are controlled up to two inches tall, while Galinsoga is controlled up to 3/4 of an inch in height. Grass control is poor, particularly with post-emergence applications. Do not apply it when temperature exceeds 85°F, as injury may occur. Late season applications control fall and winter weeds.

Some growers apply Dacthal* at transplanting followed by an application of chloroxuron when weeds begin to appear for long term weed control.

---

*Trade name

****

GALINSOGA CONTROL IN STRAWBERRIES WITH CHLOROXURON

Dominic A. Marini
Regional Fruit and Vegetable Specialist

Galinsoga has become one of the most serious weed problems in Massachusetts since most herbicides fail to control it. Two of the herbicides used on strawberries, Dacthal* and diphenamid (Dymid* or Enide*), do not control it and are not of much value on farms heavily infested with Galinsoga.

Chloroxuron (Norex* or Tenoran*), in pre-emergence or early post-emergence applications, provided effective control in 1974 tests conducted in cooperation with Nor-am Chemical Co., manufacturer of Norex*. Tests were conducted in several Massachusetts locations. The results of one test are as follows:

Galinsoga plants per square foot

Treatment	1	2	3	Average
Check	9	12	11	11
6 lbs per acre	2	0	0	1
8 lbs per acre	0	0	1	0

Treatments were applied on May 26, when weeds were up to 3/4 inch in height. Weed counts were made on June 19.

The results of this and other tests showed that chloroxuron can control Galinsoga effectively in pre-emergence or post-emergence applications up to 3/4 inch in height. Plants from 3/4 to 1-1/2 inches in height are stunted but outgrow it; the larger the plants the less stunting occurs and the sooner they outgrow it.

*Trade name

****

POMOLOGICAL PARAGRAPH

Containers for strawberry shipment. F.M. Porter and W.J. Tietjen, of the U.S. Department of Agriculture, report that in simulated shipping tests, clear polystyrene, foam polystyrene and paper pulp pint baskets caused significantly less cutting and bruising of strawberries than the widely used plastic mesh baskets (HortScience 8:August, 1973). The pressure and/or movement of berries against the multiple cutting surfaces on the sides and bottoms of the plastic mesh pint baskets caused many cuts. The type of basket had

little influence on the cooling rate of the strawberries, although those in clear polystyrene quart baskets cooled slightly slower than those in paper pulp or veneer (wood) baskets. The authors mentioned that the excellent visibility afforded by the polystyrene baskets, and the relatively small storage space needed for empty baskets, are additional assets of the clear polystyrene containers.

****

PROBLEM WEEDS IN APPLE ORCHARDS AND THEIR CONTROL

William J. Lord
Department of Plant and Soil Sciences

Although we have several good herbicides available for use in apple orchards, certain perennial broadleaf weeds such as dandelions, poison ivy, milkweed, trailing blackberries and morning glory have become a problem where chemical weed control is practiced. These weeds may have been present before the use of herbicides, but the chemical control of the more susceptible weeds has made conditions more favorable for their growth and allowed them to become more serious problems. Because of herbicide usage for the control of perennial grasses, we also have encountered an increasing problem with some annual grasses, namely, crabgrass, foxtail, fall panicum and barnyard grass, which invade the weed-free areas in mid- and late-summer. For those of you concerned with one or more of the problem weeds mentioned above, we have prepared below our suggestions for their control.

Problem Weed	Herbicide to Use	Remarks
	Perennial Broadleaf Weeds	
Brambles	Ammate X*	Contrary to some reports, we have found that 2 applications of a 2,4-D formulation in the same season failed to control brambles.
Poison ivy	Ammate X*	Weedone 638*, Dacamine* or Dacamine 4D* would be a second choice.
Dandelions, Dock, Bindweed, Plantain, and Sorrel	2,4-D formulations: Dacamine* or Dacamine 4D*	Optimum time of application will vary with weed species.

Problem Weed	Herbicide to Use	Remarks
Milkweed	Ammate X*	Terbacil or repeat application of paraquat or one of the 2,4-D formulations mentioned above may be somewhat effective.
	Annual Grassy Weeds	
Barnyard grass, Crabgrass, Yellow Foxtail and Witchgrass.	Terbacil	These weeds often invade herbicide-treated areas by August. Following the emergence of these weeds, an application of paraquat may keep the treated areas practically weed-free for the remainder of the season.
	Annual Broadleaf Weeds	
Lambsquarters and Ragweed	2,4-D formulations	Same as for annual grassy weeds.

*Trade name

****

WHAT TYPE OF RESEARCH ARE ENTOMOLOGISTS DOING ON INSECT PESTS OF APPLES?

John G. Stoffolano, Jr.
Department of Entomology

Amid the great concerns about safe and efficient use of pesticides, fruit growers rightly ask what type of research is being done by entomologists today to resolve these concerns. During 1974, I attended 4 national conferences of entomologists, at which a number of papers were presented that are of direct interest to growers. A report on one of these meetings, the Apple Maggot Conference, was published in Fruit Notes, July-August, 1974. An analysis of the papers presented at these meetings clearly shows the direction of today's entomological research.

Among the 4 meetings, 14 papers were presented on topics dealing with apple insects. Of these, 4 were on the biology of the pest; 4 were on pest management; 3 were on pheromones (sex attractants); 1 was on biological control; and only 2 were on insecticides.

A drastic shift in research has taken place within the last 10 years. Fewer studies are being conducted on the evaluation and use of insecticides in orchards. Considerable emphasis instead is being placed on the biology of the pest species, pest management practices and the use of pheromone traps as a tool in monitoring pest population.

This trend has been brought about by our increased understanding of insect pheromones plus the ability and technology to isolate and synthesize these biological agents. Renewed interests in the biology of the insect pests has certainly resulted from current pressure from the Environmental Protection Agency and legislation banning many insecticides.

Most research, consequently, has been restructured to evaluate and investigate alternate methods of pest control. The apple orchard, however, basically by the nature of its design is a simple unstructured ecosystem. Because of this, the number of different, natural parasites and predators is low compared to a more complex system. Exactly how effective biological and cultural control practices will be in controlling insect pests of apples in the future remains questionable. This, however, does not mean that research in this area is unproductive.

I would like to conclude by asking one question. Will the research that is being conducted on pest management ever get out of the confines of the experimental orchards and into the hands of the grower; and, if so, how long will this take?

****

FACTORS INFLUENCING THE SHAPE OF APPLES[1]

William J. Lord
Department of Plant and Soil Sciences

Shape of apples is an important contribution to attractiveness. It is known to be influenced by several factors, one of which is distribution of seeds in the fruits. As most growers know, apples with small numbers of seeds are frequently lop-sided with the less fleshy side being the one lacking seeds. Climate also can affect shape. In Massachusetts, J.K. Shaw in 1914 (A study of variation in apples. Massachusetts Agr. Exp. Sta. Bul. 149), reported on the relationship between shape of Ben Davis and Baldwin apples and the temperature following bloom; the cooler the temperature, the more elongated the apple. He concluded that during the post-bloom period, temperature variations between the 6th and 16th day after full bloom fitted the observed variations in shape more closely than during any other period.

In 1963, M.N. Westwood and L.T. Blaney in Oregon (Non-climatic factors affecting the shape of apple fruits. Nature 200:802-803.) reported effects of several non-climatic factors on shape of apples. In a study with Red Delicious, rootstocks were found to have a significant effect, with fruits on seedling roots, EM I, or EM XVI being more elongated than those from trees on EM VI, EM VII or EM IX. With Golden Delicious, both crop load and fruit location in the cluster affected the shape of fruits. Those from trees with a light crop (whether the result of heavy thinning or a light bloom) were longer than fruits from trees with a heavy crop. The "king" fruits were longer than side-bloom fruits.

A possible genetic effect on fruit shape also was studied by Westwood and Blaney using three strains of Red Delicious. They found that fruit shape differed significantly with strain, common Delicious fruits being flatter than Starking and Starkrimson fruits.

M.W. Williams and E.A. Stahly in Washington (Effect of cytokinins and gibberellins on shape of 'Delicious' apple fruits, Jour. Amer. Soc. Hort. Sci. 94(No. 1):17-19), suggested in 1969 that the influences of temperature, crop size, and fruit location in the blossom cluster on fruit shape are possibly related to their effects on growth regulators in the developing fruits. They showed that an application after full bloom of two kinds of growth regulators, cytokinins and gibberellins, alone and in combination increased fruit length. Cytokinin-treated fruits were longer than normal with prominent, well-developed calyx lobes, whereas those treated with gibberellin were merely longer. To the contrary, it is well known that Alar-85[2] will cause flattening of apple fruit.

Recently, C.R. Unrath in North Carolina (Jour. Amer. Soc. Hort. Sci. 99(No. 4):381-384) reported that for Red Delicious, a single spray of gibberellin (GA 4-7) plus benzyladenine (a cytokinin) applied between full bloom and petal fall appears practical, especially in areas where high post-bloom temperatures normally result in poorly shaped fruit. This spray combination improved fruit shape and increased fruit weight. (Unfortunately, gibberellin (GA 4-7) and benzyladenine have no label clearance for use in orchards.)

---

[1]This article first appeared in the Jan.-Feb., 1971 issue of Fruit Notes but due to frequent questions pertaining to factors influencing shape of apples, this article has been updated.

[2]Trade name

****

POMOLOGICAL PARAGRAPH

Effect of Alar on the response of McIntosh apple trees to chemical thinners. Last year, we reported that an application of Alar* in mid-August, 1971, increased fruit set on McIntosh apple trees in 1972, but had no influence on the thinning ability of naphthalene-acetamide (NAAm) or a combination of NAA plus carbaryl. NAA, 10 ppm or NAA, 10 ppm plus 1/2 lb of 50% WP carbaryl, seriously over-thinned while milder treatments, carbaryl, 1/2 lb of 50% WP and NAAm at 50 ppm (rates commonly used in Massachusetts) resulted in very satisfactory thinning.

It was of interest to note that the research findings of Dr. S.J. Leuty, Smithfield Experimental Farm, Trenton, Ontario (Influence of SADH (Alar*) on response of 'McIntosh' apples to chemical thinning sprays, HortScience 9:193-195, 1974) were in agreement with our results. His findings showed that Alar applied one or two consecutive seasons for preharvest drop control did not reduce response of McIntosh apples to chemical thinners the following year, and increased dosage of these materials (carbaryl or NAA) was not warranted.

*Trade name

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914
—
Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 40 (No. 4)
JULY/AUGUST 1975

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

USE OF ETHEPHON TO PROMOTE COLOR AND RIPENING OF APPLES IN MASSACHUSETTS

W.J. Lord and D.W. Greene
Department of Plant and Soil Sciences

Ethephon is proving to be of significant value to both producers and consumers of apples because a pre-harvest application of this material will stimulate red color development, increase soluble solids (sugar content) and hasten fruit maturity. These responses make it possible to advance the marketing season of apples and to have high quality fruits for these early sales. Furthermore, this chemical enables the grower to harvest a larger percentage of his crop from the trees at the first picking. Nevertheless, misuse of ethephon and/or unavoidable delay in harvest following its use could intensify our current problems of supply management and poor fruit condition with the 'McIntosh' variety. The placement in marketing channels of an excessive volume of ethephon-treated 'McIntosh' apples that must be sold quickly because of overmaturity could depress prices. <u>Ethephon must be used with caution!</u>

Successful Use of Ethephon

Ethephon will not completely overcome conditions unfavorable for development of red color. Our experience, the past 3 years, has been that ethephon at 1/2 pint added 10 to 28% red color to 'McIntosh' apples borne on the periphery of the trees within 7 or 8 days after application (Table 1). Two years' data have shown that 1/4 pint and 1/2 pint promoted comparable color increases within 7 or 8 days after application but the 1/2 pint rate softened fruit (Table 1).

Table 1. Influence of ethephon on red color development and flesh firmness of 'McIntosh' apples. Fruit harvest from periphery of the tree.

Ethephon rate[z,y]	Year	% Red color	Flesh firmness (lbs)
	9/13 (7 days after application)		
1/2 pint	1972	71	15.2
1/4 pint	1972	66	16.4
Alar*, 1-1/2 lb	1972	54	16.7
	9/19 (8 days after application)		
1/2 pint	1973	78	15.2
1/4 pint	1973	77	15.6
Alar*, 1 lb	1973	68	15.7
	9/17 (7 days after application)		
1/2 pint	1974	89	15.7
Alar*, 1 lb	1974	61	16.9

[z]All ethephon treatments were preceded by a mid-July application of Alar*. In 1972, Alar* was used at 1-1/2 lb/100 gal; in 1973 and 1974 at 1 lb/100 gal.
[y]Fenoprop (2,4,5-TP) applied with ethephon to control drop. Application rate was 20 ppm in 1972 and 10 ppm in 1973 and 1974.
*Trade name

Under conditions that are normally associated with poor fruit color, such as high temperatures, wet and cloudy weather, excessive vigor, or dense trees, the ability of the fruits to develop red color may be so low that an ethephon spray still will not bring color up to satisfactory levels within 7 or 8 days after application. Furthermore, both on young trees and older trees, ethephon may not bring the fruit in the interior of the tree up to a satisfactory level (50% of surface having red color typical of the variety) within 7 days after treatment (Table 2). When the fruit are allowed to remain longer on the tree, however, the color difference becomes greater between the ethephon-sprayed shaded fruit and the non-sprayed shaded fruit. It is of interest to note that 11 days after the ethephon spray in 1974, 66% of the interior fruit on the 10-year-old trees had typical red color and would have graded U.S. Extra Fancy. On the other hand, none of the interior fruit on the check trees would have graded U.S. Extra Fancy in regard to red color.

Table 2. The influence of 1/2 pint of ethephon applied on September 5, on red coloration of shaded 'McIntosh' apples.

Treatment[z]	Red color, 1973, (%)			Red color, 1974 (%)			
	9/5	9/12	9/17	9/5	9/12	9/16	9/19
	10-year-old trees on M.7						
Ethephon	3a[y]	42a	---	3a	58a	76a	---
Control	4a	33b	---	3a	33b	28b	
	40-year-old standard trees (30 ft spread)						
Ethephon	3a	29a	50a	1a	16a	28a	52a
Control	3a	16b	26b	1a	9b	10b	21b

[z]NAA, 20 ppm, and 2,4,5-TP, 10 ppm, used for drop control in 1973 and 1974, respectively.

[y]Means for tree type, within a column, followed by a different letter are significantly different at the 5% level.

By the time the ethephon fruits in the interior of most trees obtain adequate color, they will probably be suitable only for juice or immediate sale because of ripeness. The problem of obtaining adequate color on the interior of large dense trees can be corrected somewhat by pulling the water sprouts during the summer and doing some light summer pruning. These procedures should be followed by spot picking which will lighten the crop load and permit better light penetration into the interior of the tree before the application of an ethephon spray.

Use on early maturing varieties. Ethephon is a very useful tool on early varieties. In general, a single application applied 7-10 days before normal harvest at 1/2 pint per 100 gallons of water will increase red color development within 4-5 days (Table 3).

Table 3. Influence of ethephon on red color development on 'Niagara.' Sprayed with 1/2 pint of ethephon on August 23; harvested August 28, 1973[z].

Treatment	Red color, % 8/23	8/28	Increase in color, %
Ethephon	49	72	23a[y]
Check	48	51	3b

[z]Applied with a Hardie sprayer

[y]Means, within a column, followed by a different letter are significantly different at the 5% level.

Ethephon was used extensively on Early McIntosh, Puritan and Milton varieties by Massachusetts growers in 1974 with generally good results. Several growers observed that color developed more slowly following the ethephon spray in 1974 than in 1973, particularly with the earliest-sprayed trees which did not develop satisfactory color for 7-8 days. The color benefit from later sprays on the same variety in the same block was apparent within 3 days and the fruit were picked on the fourth day. This shows that color develops more quickly in some instances than others and that there is no substitute for a careful daily check of trees. Early varieties are notorious for uneven ripening. Therefore, it may be advisable, for some varieties, to make one picking to remove the riper fruit and then apply ethephon. This should help minimize the problem of over-ripe fruit at harvest. Some growers may wonder about the possibility of spraying the ethephon, then picking the ripe fruit that day, or 1 or 2 days later. Although the ethephon-apple label is not definite with regard to pre-harvest interval, AmChem, the manufacturer of ethephon, prefers to discourage the spraying of this chemical and harvesting the same day or 1 or 2 days later. Harvesting the mature fruit and then applying the ethephon is the preferred practice. Ethephon applied alone accelerates fruit drop. Therefore, naphthaleneacetic acid (NAA) should be used with the ethephon to counteract this abscission effect.

Use on 'McIntosh.' Our suggestions are based on 3 time periods for sale of ethephon-treated 'McIntosh' fruits---prior to normal harvest time (Labor Day or shortly after), during normal harvest, and after several months of storage (Table 4). The volume of fruits sprayed with ethephon should be based upon anticipated sales during one or more of these sale periods. The harvest of ethephon-treated fruits must not interfere with the timely harvest of fruits for CA since the placement of ethephon-treated fruits in this type of storage is not recommended. Our data and those from a regional experiment involving New, York, Maine and Massachusetts, show that ethephon-treated fruit which still are in good condition will store satisfactorily in CA, but we are concerned that apples not in good condition will be stored. However, if labor difficulties worsen, it may be necessary to extend the harvest season by advancing it through the judicious use of ethephon on CA 'McIntosh.'

Fruit to be placed in storage at 32°F must be picked at proper maturity. Fruits to be sold through January 1, should receive no more than 1/4 pint of ethephon per 100 gallons of water and be harvested 7-8 days after treatment. Although these fruits should store well until January 1, they may be softer than Alar*-treated fruits.

Table 4. Suggested use of ethephon for promoting uniform ripening and red color on 'McIntosh' apple trees.

Purpose	Compound, timing and rate
Fruit for sale 1st or 2nd week of September	Alar* - mid-July at 1 lb/100 gals plus ethephon - 8 to 12[z] days prior to anticipated harvest at 2/3 to 1 pt/100 gals. plus 2,4,5-TP same timing as ethephon spray at 20 ppm
Fruit to be picked during normal harvest and held at 32°F in air for 1 month or less	Alar* - mid-July at 1 lb/100 gals plus ethephon - 7 to 8 days prior to anticipated harvest at 1/2 to 2/3 pt/100 gals[y] plus NAA or 2,4,5-TP same timing as ethephon spray at 20 ppm
Fruit to be picked during normal harvest and held at 32°F in air as late as January 1[x]	Alar* - mid-July at 1 to 1-1/2 lbs/100 gals plus ethephon - 7 to 8 days prior to anticpated harvest at 1/4 pt/100 gals plus NAA or 2,4,5-TP same timing as ethephon spray at 10 ppm

[z]Weather and tree vigor, etc. affect color development. It may be best to allow 12 days, but be prepared to harvest sooner.

[y]2,4,5-TP is preferred if 2/3 pt of ethephon is used because its pre-harvest drop control capability is greater than that of NAA.

[x]If fruit are in good condition, they will store satisfactorily in CA.

****

DUTCH APPLE GROWING: INTENSIFICATION AND TRAINING[1]

William J. Lord
Department of Plant and Soil Sciences

Between the 1930's and 1950, apple trees planted in the Netherlands were on seedling roots, vigorous M. rootstocks (M.11, M.13, and M.16), semi-dwarf rootstocks (M.1, M.2, M.4 and M.7), or full dwarf rootstock (M.9). Shortly after World War II, spacing of seedling-rooted trees began to be reduced in new plantings to that of the vigorous and semi-dwarf rootstocks: 16-25 feet in the row and 20-30 feet between rows. Trees were trained as either central-leader or open-center type with the lowest limbs no less than 20 inches from the ground. These "bush" shaped trees were usually restricted to 10 to 13 feet in height.

Fig. 1. A 40-year-old 'Belle de Boskoop' apple tree on M.7. This is a bush tree of 16-foot height.

Today, in a well-cared-for orchard, trees of this era have 4 to 6 heavily pruned main branches with much of the growth originating from the upper side of these branches removed to increase light penetration into the tree. (Scaffold limbs pruned this severely in Massachusetts would be subject to sun scald.)

The M.9's of that era were often planted as fillers between the permanent seedling-rooted and more vigorous M. rootstock trees. Two systems of training trees on M. 9 developed. Some trees were headed-low at planting, supported by a short post and grown as bushes, while others were trained to a central leader and supported by a longer post.

---

[1]The author is indebted to Dr. S.J. Wertheim for supplying the photographs and information for the tables and for examining the paper for accuracy.

The small tree produced by M.9, with early bearing and often better fruit size and quality, soon convinced the Dutch of the superiority of this stock for their conditions. Therefore, many growers removed their "permanent" trees and replaced them with trees on M.9. They were grown predominantly as bushes.

Trends in the 1950's

The permanent and filler system was discarded and interest in seedling roots and vigorous rootstocks faded rapidly. M.9 became the most popular rootstock although a sizable number of plantings were established on semi-dwarf rootstocks in the early 1950's. Planting design became rectangular and to obtain most of the sunlight available, the tree rows extended north and south.

Fig. 2. A 4-year-old 'Golden Delicious' apple tree on M.26. This is a free-spindle tree with its characteristic whorl of 3 strong branches at the base of the leader.

Tree form changed in the early 1950's to the free-spindle (Fig. 2) which because of its conical shape allowed good light distribution along the sides of the hedgerows and within the trees. The free-spindle[2], sometimes referred to in the past as the "free round spindle," is characterized by the presence of 3 or 4, generally 3, permanent branches at the base of the leader. Above this permanent framework are short fruiting branches arranged around a central leader. These branches are kept small by pruning and renewal.

Form and training of free-spindle distances for trees on M.9 were frequently 10 feet by 13 feet (335 trees/A) for vigorous varieties, or 7 feet by 13 feet (479 trees/A) for weaker growing varieties, such as Golden Delicious. The semi-dwarfs were spaced about 10 feet by 16 feet (272 trees/A).

[2]Unfortunately, there appears to be considerable confusion in the USA on the nomenclature of the tree forms used in the Netherlands.

On limited acreage, the "layer spindle" tree form became popular. Each tree has 2 permanent limbs trained in opposite directions in the tree row (Fig. 3). The branches originating from these limbs are tied to 3 wires supported by yokes nailed to every other post in the tree row. Fruiting wood on the central leader is kept very short and of limited amount. Thus, fruit are produced mainly in the horizontal canopy of branches.

Fig. 3. An 8-year-old 'Golden Delicious' apple tree on M.9 trained as a layer-spindle tree.

Trends in the 1960's

M.9 continued to increase in popularity and by 1968 (Table 1), 82% of the trees grown by the Dutch nurserymen were on this rootstock. Actually, the figures in Table 1 are somewhat misleading because many of the trees on semi-dwarf rootstocks were exported and the Dutch imported some M.9's from Belgium and France.

Apple growing became less profitable in the 1960's due to rising labor costs which doubled between 1962 and 1967 and reduced prices due to the EEC's oversupply of apples. To help avoid the price/cost squeeze, it became increasingly necessary to obtain higher production per acre and per man-hour. This was accomplished by adoption of the slender-spindle method of training trees which permitted further intensification. In this system, the tree has a permanent whorl of 4 or 5 branches in its lower half (Fig. 4). The lowest limb is 28 inches from the ground and the leader on older trees is about 7-1/2 feet high. An older bearing tree, in a well-pruned orchard, will have a

Table 1. The trend in number of apple trees grown by the Dutch nurserymen and the rootstocks on which they were propagated.

Year	Number of trees x 1000	Percentage on rootstock M.9	M.2	M.4	M.7	Seedl.	Other
1951/52	959	15	12	21	17	16	19
1952/53	765	16	13	21	6	13	31
1965/66	2,170	56	15	12	9	0.2	8
1966/67	1,849	63	14	8	6	0.1	8
1967/68	2,214	75	10	5	4	0.1	6
1968/69	2,018	82	7	3	3	0.1	5

Fig. 4. A 3-year-old 'Belle of Boskoop' apple tree on M.9. This is a slender-spindle tree with its frame of heavy branches on the lower part of the central-leader.

total of 13 to 16 branches, half of which are 3/4 inch or more in diameter. A conical tree shape is maintained. Trained to this system, 'Golden Delicious' trees on good soil were spaced 5 feet by 11.5 feet (758 trees/A); on lighter soil 3.3 feet by 10 feet (1320 trees/A). Boskoop, a vigorous variety, on good soil, were spaced at 6.5 feet by 13 feet (516 trees/A); on lighter soil, they were spaced at 5 feet by 11.5 feet (758 trees/A).

Productivity in the orchards increased per acre and per man-hour (Table 2). Yields increased due to more trees per acre, easier production on slender-spindle trees, higher-yielding varieties such as Golden Delicious, and improved cultural techniques. Production per man-hour increased because pruning, picking, spraying, and other cultural procedures were relatively simpler with the smaller trees.

Table 2. Influence of tree type and intensification on production, yield per acre per man-hour, hours to prune and pick, and total hours to grow and harvest the crop.

	Bush-type tree, 1955	Free-Spindle 1959	Free-Spindle 1967	Slender-Spindle 1971
Yield	440	506	616	704
Lb/man-hour	44	67	109	148
Pruning hours/A	80	80	60	30
Picking hours/A	150	139	108	112
Total hours to grow and harvest crop/A	398	302	226	190

Interest in the multi-row system of planting developed in 1959 but the first trial was not established until 1966. Tree performance in 2,3,4,5 or 6-row planting systems was discussed by Dr. S.J. Wertheim at the Annual Conference of the Dwarf Fruit Tree Association in 1973 (Intensive orchards: designs and training. Compact Fruit Tree 6:105-121). He reviewed the pros and cons of each system.

and concluded that, at present, the single-row system is preferred in the Netherlands. Multi-row plantings account for only 1% of the acreage in commercial orchards.

Trend in the 1970's

The most recent development with intensification is the full-field planting (Fig. 5). In such a planting, pesticides are applied through a sprinkle irrigation system, and other cultural practices with an over-the-row tractor. Yields of 1000 bushels per acre can be obtained on 3-year-old trees (Table 3) but the investment per acre is high and harvest is a problem unless a mechanical harvester can be developed. However, several full-field plantings have been established on a commercial basis.

Fig. 5. A full-field planting of 'Melrose' apple trees on M.9 at the spacing of 0.80 meters by 1.50 meters. Trees planted in the spring of 1972; photograph taken in October, 1974. Sprinklers operating merely to show how pesticides are applied.

Table 3. Yield of two apple varieties in single row and full-field plantings at Wilhelminadorp Research Station. Trees planted in 1972.

Planting system	Trees per acre	Yield per acre (40-lb bushel)[1] G. Delicious 1973	G. Delicious 1974	Karmyn 1973	Karmyn 1974
Single row	800	75	238	103	352
	1600	190	420	238	576
Full-field	1600	206	372	222	436
	3200	396	1061	523	1204

[1]Tree number was reduced 10% when figuring yields to allow for working space in planting.

Summary

Since the late 1930's, tree number per acre has increased from 20-40 trees in standard orchards, to 680-1200 trees in the slender-spindle orchards. Planting design has changed from the square planting for standard trees to the rectangular systems for slender-spindle orchards. More recently, interest has developed in multi-row and full-field planting systems but, at present, single rows are preferred in the Netherlands.

****

POMOLOGICAL PARAGRAPH

Effectiveness of Alar as influenced by coverage. A study conducted by B.L. Rogers and E.R. Kristensen entitled "Preharvest Drop of 'Stayman' Apples as Influenced by SADH (Alar*) in Dilute and Concentrate Form" and published in HortScience 8:314 (August 1973) showed the importance of good coverage for preharvest drop control. Spray equipment which had given good pest control in apple orchards when sprays were applied up to 33X failed to provide adequate preharvest drop control on 'Stayman' apple trees when Alar* was applied at 3X or higher. The failure to get effective drop control with concentrates of 3X or higher was probably due to poor spray coverage. There is little or no translocation of Alar from sprayed to non-sprayed branches, so thorough spray coverage is required for best results regardless of spray concentration.

*Trade name

****

McINTOSH APPLES IN SCOTLAND

William J. Lord
Department of Plant and Soil Sciences

McIntosh apples exported from New England to Scotland go to Rotterdam, Netherlands, then are transferred to smaller ships for transport to Edinburgh, Scotland. The apples are handled by Rankins Fruit Markets, Ltd., a small importing firm in Edinburgh. In addition to being importers, Rankins have 18 specialty shops which sell fruits, vegetables and flowers.

McIntosh apples from both New England and Canada are found in Edinburgh stores. The red color and soft flesh make McIntosh a popular eating apple, particularly with older people. However,

younger people (and the English in general), like the firmness and quality of Cox Orange or Golden Delicious or the tartness of Granny Smith in preference to McIntosh. Which size of McIntosh is preferred? Either 140- or 160-count is always mentioned as the best size. The 200-counts are considered too small except for customers having small children.

One cannot help but wonder if the McIntosh name helps to sell the variety which is frequently spelled "MacIntosh" in Edinburgh stores. Also, it was of interest to note that they are advertised by origin -- "American MacIntosh" or "Canadian MacIntosh."

Rankin Specialty Stores

The American McIntosh displayed in the window of the Rankin stores made a striking contrast to Golden Delicious from the Netherlands or France. The author was proud of them! Golden Delicious from the Netherlands varied considerably in color, while those from France were uniformly green. The German market prefers a green-colored Golden Delicious, so the same may be true in Scotland and England. At the time of my visit, the McIntosh, French Golden Delicous, and Dutch Golden Delicious, all of which were Class I fruit, were priced 48, 43.2, and 33.6 cents per pound, respectively.

With the exception of a trayed gift pack of assorted fruit, all fruit and vegetables in the Rankin stores are displayed in bulk. They have no self-service. I spoke with a very knowledgeable woman, Mrs. Gillon (a member of the Rankin family with 55 years experience in retailing) who supervises one of the stores. She believes that customers should not be allowed to handle fruit and vegetables because of damage they cause through rough handling. She also was of the opinion that people like the personal service furnished by the Rankin stores.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S. MAIL

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 40 (No. 5)
SEPTEMBER–OCTOBER, 1975

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 40 (No. 5)
SEPTEMBER–OCTOBER, 1975

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

HARVESTING AND STORING APPLES: A TIME FOR OBSERVING DETAILS

W.J. Bramlage and F.W. Southwick
Department of Plant and Soil Sciences

The apple harvest season is a hectic time for a fruit grower. His attention is often focused on his harvest labor, and perhaps on his harvest sales operation. And, unfortunately, something may have to "give." Don't let it be your storage operation! Shortcuts or mistakes in September can mean disaster in April. If a grower is to market quality fruit in the spring, he must pay attention to details in the fall. Some comments follow on things to be watched.

Weather. Hot weather shortly preceding and during harvest is generally detrimental. It ripens fruit rapidly, leading to harvesting of overmature apples with shorter storage life. It results in poorer coloring, especially if night temperatures are high, and again leads to harvesting riper apples because it is necessary to wait for at least 33% red color. It increases susceptibility to scald, making effective scald treatments crucial. If it's hot during the harvest period, the hot apples increase the heat load going into a storage room. Unless ample refrigeration is available, it is probably best to allow these hot apples to cool overnight in the orchard, and bring them into storage early the next morning.

If the weather is cool just before and during harvest, the prospects for high quality fruit in the Spring are much better. Nevertheless, there is need to get apples off the tree and into storage as quickly as possible. The riper the fruit at harvest, the shorter is its storage life. With late varieties, freezing is a concern. If it gets cold enough that apples freeze, a whole new set of problems arise. Freezing causes softening, and probably promotes fruit breakdown during storage. It is probably correct to assume that any freezing causes damage and that fruit that has been frozen should not be stored for long periods. If frozen to a temperature of about 20-22°F, or for too long a time, the apples will be killed and will begin to brown soon after thawing.

Fruit maturity. Maturity is the stage of development at harvest. If too immature at harvest, fruit will never develop top quality flavor and may be more subject to shriveling, scald, bitterpit and browncore after harvest. If overmature, fruit will deteriorate quickly and be more subject to softening, breakdowns and rots.

How to identify maturity is a difficult question. Pressure test, color (especially undercolor), abscission, and flavor are helpful guides, but experience with your own fruit may be your best measure. Use of growth regulators has made this an even more difficult question. Alar* delays maturity, but not as much as many people think. Its phenomenal drop control capability and its delay

*Trade name

of softening can be misleading. Do not delay harvest of Alar*-treated fruit; a significant amount of the firmness difference between Alar*-treated and untreated fruits will disappear rapidly during storage. Ethrel* hastens maturity, and despite our belief that Ethrel*-treated fruits can be stored if harvested at the right time, we think that it's extremely dangerous to try to CA-store Ethrel*-treated apples commercially. The hormone-type Stop-drop sprays also promote maturation, and should be used with this understanding.

Further complicating the maturity problem is the use of red strains and dwarfing rootstocks. Since for marketing reasons harvesting is usually gauged by red color, the red strains are probably an advantage to proper storage management since less mature (and longer keeping) fruit may be harvested. However, among the strains of 'Delicious' it is well known that some red strains mature well ahead of others. Therefore, it cannot be assumed that red strains are just like the standard strains except for color; other criteria must also be watched. It is very likely that some rootstocks influence maturity, although this must yet be defined. European studies suggest that fruit from M.9 rootstocks have higher Ca levels and less bitterpit than fruit from M.M.104 rootstocks. Again, you cannot assume that fruits from dwarfing-rootstock trees are the same as those from seedling-rooted trees. You must watch these fruits closely.

Just when to harvest apples for maximum storage life is perhaps the most frustrating question to face. In Massachusetts, flesh firmness of at least 15 to 17 lbs (if Alar*-treated, 16 to 17 lbs) is considered essential for 'McIntosh' if they are to be stored in CA. Most of the problems of immaturity can be dealt with, but most of the problems of overmaturity cannot be overcome except through rapid disposal of the fruit. Overmaturity is likely the greatest cause of storage problems. It is better to pick a little too soon than a little too late.

Pre-storage operations. It is absolutely essential that apples be cooled quickly and thoroughly before storage if they are to be stored effectively. Ideally, the fruit should be cooled to 32°F within 24 to 36 hours after harvest. Use of bulk bins increases the cooling problem. Cooling systems of many older storages were designed for slower loading rates than occur with use of bulk bins. The bulk of fruits within bins interferes with heat exchange: centers of the bins remain warm long after the surfaces have cooled. Furthermore, arrangement of the bins in the storage room often is without regard to correct air flow patterns, and cooling is delayed still further. Few growers have any idea what the temperature of their fruit actually is in the storage. Those who have measured it have been surprised; air temperature is a very poor gauge of the apple temperature. Inadequate cooling undoubtedly is another major source of storage problems.

Apples susceptible to scald should be treated with an inhibitor before storage if they are to be stored beyond early January. Postharvest dips are very effective if used properly; however, Dr. Robert Smock recently commented that he was shocked last fall when he traveled around New York and saw how scald inhibitors were actually being used. Follow the recommendations with care if you want to be successful.

If a postharvest dip is being used, it is wise to add a fungicide. A circular on "New England Suggestions for Postharvest Fruit Rot and Storage Scald Control" is available from your Regional Fruit Specialist. Benlate* has given excellent decay control on apples, but it should be noted that Benlate* seems to be unusually conducive to development of resistant strains of fungi. If Benlate* has been used during the growing season, there is a possibility that a resistant strain is present on the fruit. Furthermore, it is suggested that treated fruit be removed from the dipping area as quickly as feasible to avoid buildup of resistant spores. Much can be done to reduce storage decay problems by preharvest sanitation treatments; this was carefully described in Fruit Notes by Dr. C.J. Gilgut in 1972 (Fruit Notes, Sept.-Oct.:pp.2-7).

If a postharvest dip is used, calcium chloride ($CaCl_2$) may also be added to raise the Ca level of the fruit. This practice is commercially employed in several areas of the world, and we have been conducting tests for the past two years. Several growers in Massachusetts will use $CaCl_2$ dips this fall on a limited scale but we feel that more trials are essential before we can make any general suggestions.

Storage operations. CA rooms should be filled and sealed as quickly as the apples can be properly cooled. Growers have been sealing their rooms later in the fall in recent years, and we feel that this is contributing significantly to storage problems. The longer the fruit remain in air after harvest, the less benefit CA will have on them. However, if it is a question of thorough cooling or early sealing, choose thorough cooling.

Storage temperature is a vital factor. Fruits should be at 30-32°F when a room is sealed: 'McIntosh' should then be allowed to rise to 37-38°F while the CA atmosphere (3% O_2, 5% CO_2) is being attained. It is important to store at the proper temperature, not near it. Temperature 1° or 2° above the recommended point can sharply reduce storage life.

'Cortland' has been successfully stored at 32°F in recent years, and this has lead to the question of whether 'McIntosh' should not also be stored at 32°F. Those who have studied the effect of temperature on 'McIntosh' emphasize that while they may keep well at 32° in the occasional year, 'McIntosh' generally will not tolerate this temperature for long-term storage (brown core and off-flavors may develop). A storage operator should measure

temperature as accurately as he possibly can. A highly reliable, calibrated thermometer is the minimum gauge. Thermocouples that are now readily available are quite desirable for monitoring temperature.

The most beneficial CO_2 level in a CA atmosphere is being re-evaluated (See the accompanying article.). However, at present, we still recommend 3% O_2 with 5% CO_2 for "soft" rooms, and 3% O_2 with 3% CO_2 for "hard" rooms. Recent results do suggest that CO_2 need not be kept low at the beginning of CA, however. Therefore, we recommend a rapid "pull-down" of O_2 to 3% without concern for the CO_2 level, which can be adjusted later. It appears that some growers have been placing excessive amounts of lime in CA rooms, so that CO_2 never reaches 5%. If the CO_2 remains low during storage, much of the CA effect will not occur. Based on recent observations, the practice of putting lime in the CA room seems debatable unless the scrubbing system is simply inadequate.

The proper humidity for storage is also being re-evaluated. It is clear that a relative humidity very near 100% can increase breakdown problems. However, storages are more likely to have too low a humidity than too high a humidity, since humidity is hard to maintain in many storages. Storage operators are encouraged to do everything possible to maintain a high relative humidity as this question is looked at more closely.

Careful observations and record keeping do not end with attainment of the CA condition. Atmosphere and temperature should be monitored and recorded daily. If the O_2 falls below 3%, it should be brought back up immediately. Storage conditions should be watched closely and recorded. (The gas analyzer, the aspirator bulb, and all sample lines should have been carefully checked before sealing, and any indication of malfunction during storage should be checked-out immediately. Porous aspirator bulbs which result in higher O_2 readings than actually exist in the room, have been responsible for severe low O_2 injury to fruit.) It is well to sample fruit periodically during the storage season. (See: "The Soft McIntosh Problem" Fruit Notes, Sept.-Oct. 1974:pp. 1-4.)

Successful storage operation requires attention to details, from the beginning of harvest to the sale of the last apples. Any mistake or oversight can be disastrous, especially with the trend to longer storage periods: the longer apples are kept, the more important are the details. The successful operator should recognize a problem as it develops, and adjust his marketing practices accordingly. For example, if cooling in some fruits has been inadequate, these fruits should be disposed of as quickly as is feasible. Long term storage should be attempted only with apples that have "everything going for them." Long-term CA does not correct mistakes; it only underlines them.

****

NEW BOOKS ON POSTHARVEST HANDLING OF FRUIT AND VEGETABLES

W.J. Bramlage
Department of Plant and Soil Sciences

Until recently, few books were available on postharvest handling of fruits and vegetables. But within the past couple of years a series of books has appeared that may be of interest to many readers.

1. "Handling, Transportation, and Storage of Fruits and Vegetables. Volume 1. Vegetables and Melons" (1972. by A. Lloyd Ryall and Werner J. Lipton.)

   "Volume 2. Fruits and Tree Nuts" (1974. by A. Lloyd Ryall and W.T. Pentzer.)

   The Avi Publishing Company, Inc., Westport, Connecticut. Volume 1, $21.00. Volume 2, $34.00.

   These two volumes give a broad view of handling requirements and practices of many different fruits and vegetables.

2. "Postharvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables" (1975. by E.B. Pantastico.) The Avi Publishing Company, Inc., Westport, Connecticut. $39.00.

   This book includes a great deal of information about the nature and composition of fruits and vegetables as well as specific information about certain commodities.

3. "The Biology of Apple and Pear Storage" (1973. by J.C. Fidler, B.G. Wilkinson, K.L. Edney, and R.O. Sharples.) Commonwealth Agricultural Bureaux, Central Sales, Farnham Royal, Slough SL2 3BN, ENGLAND. $13.00.

   This is an excellent publication relating only to apples and pears, but summarizing many years of findings by the English on storage conditions, physiological disorders, diseases, and orchard and climatic factors influencing storage behavior. It contains many excellent colored photos of disorders.

****

RE-EVALUATING THE CO_2 LEVELS FOR CA APPLE STORAGES

W.J. Bramlage
Department of Plant and Soil Sciences

In 1973 (Fruit Notes, Sept.-Oct.), we reported that recommendations for CO_2 levels in CA apple storages were being re-examined. Since then, we and others at a number of different experiment stations have been testing the use of short periods of high CO_2 at the beginning of CA, as a means of delaying ripening, and especially softening during and following CA storage.

The widespread interest in this technique arises from the excellent results that Dr. H. Melvin Couey and his colleagues of the U.S.D.A. in Wenatchee, Washington have obtained on 'Golden Delicious.' They began high CO_2 tests in 1971, and their technique has been so successful that it was given an industry-wide test on Washington 'Golden Delicious' last year. Their treatment consists of simply raising the CO_2 level to 20% (in 4-5% O_2) for the first 8-10 days of CA or to 15% (in 4-5% O_2) for the first 15 days, followed by the normal CA atmosphere. They have found the 'Golden Delicious' treated in this way to be 2 lbs firmer than normal CA fruit in February, and to continue to be significantly firmer and have a better flavor throughout the remainder of the storage season.

The possibility that 'McIntosh' quality after storage might also be improved by a similar treatment has been pursued at several experiment stations. We have conducted substantial tests during the past 2 storage seasons with mixed results, but these tests have illustrated the potentials for both benefit and damage.

In the 1973-74 storage season, we treated 'McIntosh' and 'Red Delicious' with high CO_2. Using an Arcat* generator, we "pulled down" O_2 to 3% but did no CO_2 scrubbing. The CO_2 level during pull-down rose to about 9%, and during subsequent weeks slowly rose to about 11%. Apples kept at these high CO_2 levels at 38°F for up to 9 weeks before being transferred to a normal McIntosh atmosphere of 3% O_2, 5% CO_2 and 38°F, and samples were examined for quality in January, March, and May. There was no benefit to 'McIntosh' from these treatments, and while 'Delicious' held in high CO_2 for 3,6 or 9 weeks were firmer in January than ones in normal CA, the differences disappeared during later storage. We concluded that 9% CO_2 at the beginning of CA was of no value to 'McIntosh,' but we also were impressed by the lack of any injury to the fruit, even after 9 weeks exposure to 9-11% CO_2. This suggested that the apples had more tolerance for CO_2 than we had believed.

In the 1974-75 season, we decided to test this tolerance with some extreme treatments on 'McIntosh' and 'Cortland.' Again, O_2 was "pulled down" without scrubbing and CO_2 was then added to the

*Trade name

CA to raise the atmosphere to either 12% or 15% CO_2 (with about 3% O_2). Samples were kept at 38°F in 12% CO_2 for 3 weeks, and in 15% for 1,2, or 3 weeks, before transfer to 3% O_2, 5% CO_2 and 38°F; samples were examined in January, March and May.

The effects of the treatments on fruit firmness are shown in Table 1. Benefit to 'McIntosh' was substantial. All treatments retarded softening, and the effect persisted throughout the storage season. These values are for fruit kept 1 day at room temperature after removal from storage, but substantial differences were also measured after 7 days at room temperature, so the benefit should carry through to the consumer. 'Cortland' apples responded less than 'McIntosh'; only 15% CO_2 for 3 weeks produced a measurable difference in May.

The benefit to 'McIntosh' was obtained at a price; CO_2 caused injury to some fruits. CO_2 injury can be of 2 forms: an exernal scald-like injury on the green portion of the fruit; and, an internal damage characterized by dry pockets in the flesh, that often leads to breakdown of the fruit. Both forms of CO_2 injury appeared in and on 'McIntosh.'

The scald-like injury occurs during the CO_2 exposure and was detectable at all examinations. It resulted from all treatments to 'McIntosh,' but the amount of injury was usually only 1-2% of the total number of fruit. This injury can be sorted out easily, gets no worse during later storage, and would probably be tolerable because of the firmness benefits obtained on 'McIntosh.' 'Cortland' showed none of this injury.

The internal injury is of much more concern. It was not detected until May, could not be removed by sorting, got worse with time, and was worse in larger than in smaller fruits. The percent occurrence was not determined, but some internal injury was present in all the treated samples of 'McIntosh.' This injury is probably not tolerable. Again, however, injury did not occur in 'Cortland' from any treatment.

The 1974-75 test clearly illustrated that 1) high CO_2 can sharply retard softening of 'McIntosh,' but 2) 'McIntosh' can be severely injured if exposed to too high a CO_2 level at the beginning of storage. Thus, it is obvious that considerable work remains to be done on this subject.

Other experiment stations have also been examining high CO_2 treatments on 'McIntosh' during the past several years, and their findings suggest that 12-13% CO_2 for about 2 weeks at the beginning of CA may be optimum. However, many questions must be answered before any commercial recommendations can be made. Some of these questions are: How quickly after harvest must the high CO_2 level be obtained to influence firmness? (Dr. Couey finds half the benefit to 'Golden Delicious' to be lost if treatment is delayed only 10 days.) Is the benefit related to maturity of the fruit at har-

vest? How much do temperature, O_2 level, and storage humidity during the high CO_2 treatment influence benefit or injury? Can the high CO_2 treatments be extended beyond 2 weeks? What is the sensitivity to CO_2 of other varieties that might be in the room with 'McIntosh?'

To attempt to answer these and other questions in the shortest period of time, a joint experiment has been designed for the coming season at Cornell University, Michigan State University, University of Guelph (Ontario, Canada), Agriculture Canada Research Station, Summerland, British Columbia, and the University of Massachusetts. Personnel at each of these locations will conduct a basic experiment with 'McIntosh' with each institution examining at least one of the above questions.

It is hoped that this joint research approach will substantially decrease the length of time needed to determine the feasibility of high CO_2 treatment in retarding softening of 'McIntosh.' Excessive softening of 'McIntosh' is a severe problem, and the use of high CO_2 may be a simple approach to lessening the problem. But the possibility of CO_2 injury is a constant threat that will require much data and much caution before commercial trial on 'McIntosh.' Unfortunately, we are working with a variety that appears to be more susceptible to CO_2 injury that 'Golden Delicious,' and we cannot simply apply the results from Dr. Couey's tests in Washington to our conditions in Massachusetts.

Table 1. Effects of high CO_2 levels at the beginning of CA storage on firmness of apples.

Treatment	Firmness (lbs pressure) after storage to: January	March	May
		McIntosh	
5% CO_2, 3% O_2, (CA)	11.4	9.8	9.4
12% CO_2, 3% O_2, 3 wk.*	12.9	10.9	9.9
12% CO_2, 3% O_2, 6 wk.*	13.0	10.9	10.4
15% CO_2, 3% O_2, 1 wk.*	12.5	10.4	9.8
15% CO_2, 3% O_2, 2 wk.*	13.1	12.0	10.7
15% CO_2, 3% O_2, 3 wk.*	13.8	12.7	10.2
		Cortland	
5% CO_2, 3% O_2, (CA)	11.1	10.7	10.5
12% CO_2, 3% O_2, 3 wk.*	11.9	11.4	10.7
12% CO_2, 3% O_2, 6 wk.*	11.5	11.1	10.6
15% CO_2, 3% O_2, 1 wk.*	11.3	11.0	10.5
15% CO_2, 3% O_2, 2 wk.*	11.9	11.2	10.7
15% CO_2, 3% O_2, 3 wk.*	12.2	11.5	11.3

*Followed by 5% CO_2, 3% O_2 for duration of storage period.

****

NEW EXTENSION ENTOMOLOGIST

Dr. John G. Stoffolano, Jr., Acting Chairman for the Department of Entomology, is pleased to announce the addition of Dr. R. J. Prokopy to its staff. Dr. Prokopy will officially assume his new position of extension entomologist starting September 1, 1975.

A graduate of Cornell University, Dr. Prokopy received his doctorate's degree in economic entomology under the supervision of Dr. G. Gyrisco. After working four years as an assistant entomologist at the Connecticut Agricultural Experiment Station, Dr. Prokopy spent several years overseas: 1 year in Poland at the Institute of Pomology, 1 year at the Swiss Federal Research Station working on cherry maggot, and 1 year as a United Nations, Food and Agriculture Overseas consultant at the Democritos Research Center in Athens, Greece, where he worked on the olive maggot. Following this, he was appointed a research associate at the Department of Zoology, University of Texas, where he researched the *Rhagoletis* complex. Dr. Prokopy was invited to participate in the recent Gordon Conference on Herbivore Plant Interactions, held this summer in New Hampshire.

While at the Connecticut Agricultural Experiment Station, he published several bulletins entitled, "Experiments on control of insects and mites on the fruits in Connecticut." Currently, he has an extensive review article in press entitled, "Biology and management of *Rhagoletis* flies."

Dr. Prokopy has a personal feeling for fruit growing, having maintained an apple orchard in Wisconsin. Dr. Prokopy has worked closely with Zoecon on developing baited traps for apple maggot and this summer has a Rockefeller Foundation Grant in conjunction with Dr. W. Roelofs from the Geneva Experiment Station in New York State. Dr. Prokopy has expressed his enthusiasm to return to the East where he was born (Danbury, Conn.) and is looking foward to research on the fruit pest complex here in Massachusetts.

****

UNUSUAL WEATHER IN THE NETHERLANDS

William J. Lord
Department of Plant and Soil Sciences

Rainfall in July through November, 1974, at the Wilhelminadorp Research Station was 166% of the 1951 through 1973 average. As a result of excessive rainfall throughout the Netherlands, the harvest of many crops was prevented or delayed. For example, it was predicted that about 25,000 acres of potatoes would be lost.

Last fall, some meteorological experts in Europe were forecasting the bitterest, longest, and nastiest winter for a century. In fact, all of Europe enjoyed the mildest "non-winter" in living memory until late February. The mild weather permitted the harvest of potatoes during the winter months and as a result only 5000 to 7500 acres were not harvested instead of the predicted 25,000 acres.

The first freezing temperatures at the Wilhelminadorp Research Station occurred on the morning of February 5, 1975. 'Blue Rock,' the earliest plum variety at the research station, commenced bloom on February 13. This variety normally blooms in early April. Thus, at this time, the season was about 2 months advanced.

The weather turned cooler after mid-February and the 'Blue Rock' plum variety was not in full bloom until March 12. By mid-March, fruit trees in some orchards had been sprayed once or twice and scab lesions were found on pear fruit on March 27. By mid-March, the season was considered to be advanced by 3-4 weeks.

Cool weather persisted in late March and early April. The first snow of the winter at Wilhelminadorp occurred on Easter and the temperature was 18°F, lower than on Christmas. Fortunately, growth advanced very slowly throughout April and as a result bloom date of apples was "normal" at Wilhelminadorp (first week of May). Thus, 1975 season changed from 2 months advanced to normal and points out the needlessness of worrying about the weather over which you have no control. The view that "normal weather is unusual weather" has validity. Extreme conditions during the growing season usually, for the most part, evens out by the beginning of apple harvest.

****

ORCHARD MOUSE CONTROL

Edward R. Ladd, Wildlife Biologist
U.S. Fish & Wildlife Service
Hadley, Massachusetts

The time for fall control of mice in orchards is here. As in previous years, a check of the orchard should be conducted to determine which blocks or areas show higher than usual mouse activity. These areas should receive extra care in treatment and, if necessary and if time permits, a follow-up treatment should be made.

Some orchard blocks were hit harder than usual during the latter part of this last winter. Damage in most cases was along the edges of blocks adjacent to unmowed fields. Migration of mice in search of food from these untreated areas was the apparent cause and indicates the need to create a treated buffer strip around these blocks.

Control practices are the same as for previous seasons. For the control of meadow mice, reduction of vegetative cover during the growing season will help. During the winter, under snow cover, it will have little effect.

The use of zinc phosphide-treated baits still is recommended for the control of both meadow and pine mice. Bait broadcasted at the rate of 6-10 pounds per acre should give adequate control of meadow mice.

For pine mice, broadcasted bait will give some control. Better results will be achieved if zinc phosphide baits are trail baited either by hand or machine.

NOTE: Before applying any toxic bait, a permit still is required from the Massachusetts Division of Fish and Wildlife, 100 Cambridge Street, Boston, Massachusetts 02202.

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE

AGR 101

U.S.MAI

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 40 (No. 6)

NOVEMBER/DECEMBER 1975

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

FRUIT VIRUS RESEARCH AND THE INTRODUCTION OF VIRUS-FREE TREES TO FRUIT INDUSTRY IN THE NETHERLANDS

Dr. Ir. H.J. van Oosten*
Research Station for Fruit Growing, Wilhelminadorp

After World War II, research on fruit tree viruses expanded rapidly throughout the world. Initially, most of the research was conducted in England and the USA. In 1953, virus research with fruit trees was started in the Netherlands by the Plant Protection Service. This agency established that several viruses known to occur in apple and pear in other countries were also present in the Netherlands. Later, the Institute of Phytopathological Research in Wageningen, the Netherlands, started more basic fruit virus research. They found better indicator plants for some viruses than those which were generally used, with quick and distinct symptom expression after infection. The Plant Protection Service and the Institute of Phytopathological Research were also involved in the production of virus-free trees. The value of virus-free plant material for the fruit industry was examined by the Research Station for Fruit Growing at Wilhelminadorp while the propagation of the promising virus-free material was organized by the General Inspection Service for Woody Nursery Stock. Thus, 4 organizations are involved in the fruit virus research, evalution of virus-free material, and the release of the new material to the fruit industry. This paper will briefly review why the virus program was started, research results, and the organization for the release of virus-free material.

Virus-infected Trees

It has been shown that several important diseases of fruit trees are caused by viruses: rubbery wood, mosaic, chat fruit, proliferation, star crack, and rough skin in apple; vein yellows, ring mosaic, and stony pit in pear. Especially in the USA incompatibility of some cultivars with important stocks like Virginia Crab and Northern Spy were found to be caused by viruses. In some cases, yield losses up to 50% were reported. But several viruses also were detected that gave no symptoms on the leaves, stems or fruits of the main cultivars (varieties). These viruses were called the "latent" viruses. When each of these "latent" viruses occurred separately, no effect on growth and production could be detected, but when more than one was present (as often is the case) tree growth and yield reductions could be measured in trials. Thus, it was concluded that many viruses were harmful to apple and pear trees and that the problem was serious enough to warrant investigations of ways to eliminate viruses from apple and pear.

---

*Researcher on virology, clones, rootstocks and interstocks

Virus-tested Trees

The initial research of the Plant Protection Service showed that some harmful viruses (like rubbery wood in apple and vein yellows in pear) were widely spread in Dutch fruit orchards. Latent viruses occurred in most trees, especially in those on the most important rootstocks. Therefore, the Plant Protection Service initiated a program to find trees free of the most important viruses. Thousands of trees from commercial orchards were tested on indicator plants but only a few trees proved to be free of the most important viruses. The virus-free trees were used to build up a new stock of mother trees and rootstocks. This plant material was named "virus-tested," because of the absence of some important viruses (rubbery wood, mosaic, proliferation and fruit attacking viruses in apple; vein yellows, ring mosaic and stony pit in pear). However, the problems were how to introduce this material into the fruit industry and how to guarantee and to maintain the absence of some viruses. In the old system, every nurseryman had his own mother trees of cultivars and stoolbeds of rootstocks and the General Inspection Service controlled only the authenticity of the cultivars and rootstocks. Now it was thought that the General Inspection Service should also control the health of the plants. Therefore, it was decided that growing of "virus-tested" mother trees should be centralized on a special plot under the control of General Inspection Service. Since about 1965, hundreds of "virus-tested" mother trees of most cultivars have been planted. All nurserymen are obliged to buy their bud- and graftwood from these mother trees. The virus-tested rootstocks are propagated in commercial nurseries but are strictly controlled by the General Inspection Service. This system has worked quite well.

Virus-free Trees

About 1960, a new technique became available for the production of trees free of all known viruses: heat treatment. Plants are grown in a climate chamber at 37°C for 6-8 weeks and very small tips (5 mm or less) of new growth are grafted to apple and pear seedlings, free of all known viruses. Usually 95% of the tip-grafts made on the seedlings survive. Generally, several sources of each cultivar are treated. The tip-grafts produced are usually free of any virus contamination. However, it is necessary to test every tip-graft on indicator plants to be sure of the absence of viruses. These tests for viruses causing symptoms on leaves and stems usually take 3 years, while those for viruses causing symptoms on fruits may take 6 years.

The Research Station for Fruit Growing at Wilhelminadorp obtained some trees resulting from the tip-grafts for pomological tests and the General Inspection Service was allowed to build up a stock of heat-treated material. However, generally no material was released until the completion of the virus and pomological tests.

Pomological Tests

A. Comparison of virus-free and virus-infected trees

At the Wilhelminadorp Research Station and the 6 experimental gardens in the Netherlands, trials are established to compare the "old" virus-infected trees, the virus-tested trees, and "the new" virus-free trees. So far only preliminary results have been obtained (van Oosten 1974 and 1975), but these seem to confirm, in general, the older data of the English research stations at Long Ashton and East Malling in that (a)virus-free trees grow more vigorously than virus-infected trees; (b)virus-free trees usually produce larger yields than virus-infected trees; (c)the yield efficiency (pounds per unit of growth) of virus-free trees is equal or higher than of virus-infected trees and (d)fruit quality (color, smoothness of fruit skin, grade) is also usually better for virus-free trees.

These conclusions underline important advantages of virus-free trees. But in the Netherlands, the stronger growth of virus-free trees is not always considered as positive. The planting system in the Netherlands is based on small trees on weak (virus-infected) M.9 rootstock with tree spacing of 10.7 or 11.6 feet between the row and 4.1 or 4.9 feet in the rows, depending on the cultivar. Tree height does not exceed 8.2 to 9.8 feet to permit picking without ladders. The stronger growth of virus-free trees will affect tree-spacing, tree height, and perhaps increase pruning time.

The Dutch experiments have shown that on apple replant soil* the stronger growth of virus-free trees seems to be acceptable in the first years after planting (Table 1). The growth of normal virus-infected trees in replant soil is often considered to be too weak in the first years after planting. It is questioned how growth of virus-free trees will develop later. In experiments on new land for apple, the growth is considered too strong, especially for some strong-growing cultivars (Table 1). It is expected that on new land planting distances may have to be greater. It is questioned what the influence will be on tree height in later years and what the consequences are for yield per acre. The growth of virus-free trees especially on fresh apple soil will be one of the main concerns of Dutch fruit research in the next years.

B. Testing of tip-grafts

In the trials mentioned above, only a very limited number of tip-grafts of a few cultivars is included. Most of the produced virus-free tip-grafts are therefore studied in other trials at the Wilhelminadorp Research Station and the Experimental Gardens. This is to be sure that no unexpected mutations have occurred and to

---

*Soil previously planted to apples. Trees grow less vigorously in replanted soil than in "new" soil or in fumigated replant soil.

avoid mistakes with the material which may be released to the fruit industry. Three trees of every tip-graft are made, using the virus-free M.9 rootstock. Characteristics of growth, production and fruit quality are studied for about 3 years. This program for testing of each tip-graft for pomological characteristics started in 1972. The value of these tests is beyond doubt. Some unexpected events have already been detected. For example, in the important Dutch cultivar 'Red Boskoop', the 'Schmitz-Hubsch' a mutant with striped fruits was obtained after heat-treatment at 2 different institutes. Other tip-grafts from the same source of the cultivar had normal fruits.

Table 1. The growth per tree (meters) of virus-free and virus-infected trees of 'Golden Delicious' on M.9 on fresh and replant soil.

Virus status	Growth per tree (meters)		
<u>Fresh soil</u>	1972[1]	1973[2]	1974[2]
Virus-free	2.9	6.3	28.1
Virus-infected	2.4	4.2	18.2
<u>Replant soil</u>			
Virus-free	3.2	4.8	11.9
Virus-infected	3.2	3.2	7.9

[1]In the nursery

[2]After planting in the orchard

C. Comparison of different virus-free sources of one cultivar (variety).

It is well known that different sources of a cultivar may differ in growth, production and fruit quality. There are two main reasons for this: (a)the sources differ in virus-contamination; and (b)genetic variation.

In the Netherlands, the virus-induced variation in the cultivar 'Cox's Orange Pippin' is well known. In almost every orchard of this cultivar, poor and heavy bearing trees occur. But, there seems to be a genetic variation also. Campbell (1974) found that the virus-free English clone of 'Cox's Orange Pippin' was less productive than some virus-infected commercial sources of the cultivar. These virus-infected sources will be heat-treated and it is hoped that a heavy-bearing 'Cox's' clone can be found. Similar work is now being done in the Netherlands with the most important cultivars. In one trial, differences in smoothness of the fruit skin has been found among the 4 virus-free sources of 'Golden Delicious' (Table 2). These results were very important to Dutch fruit industry.

It has led, for example, to the complete replacement of mother trees of 'Golden Delicious' by the two best sources, No. 2 and No. 5. These are now generally known as clone A and B, respectively. Differences in production between virus-free sources of 'Anjou' pear were recently reported by Westwood and Cameron (1974). Thus the virus story will not end with the removal of viruses by heat treatment of a cultivar. The choice of the source of a cultivar before heat treatment is also of importance. The comparison of different sources of one cultivar will therefore have the attention of our research station in the next years.

Table 2. The skin smoothness of 4 different virus-free sources of 'Golden Delicious' on M.26. Mean for the 1971 through the 1974 harvest seasons.

Source No.	Smooth fruit (%)
2	33.4a[z]
5	28.7ab
1	24.2bc
3	20.6c

[z]Means followed by the same letter are not significant at the 5% level.

Propagation

When the virus and pomological tests are completed, the collaborating organizations jointly decide which tip-grafts of a cultivar are worth multiplying for release to the fruit industry. For rootstocks, the virus tests are the main basis for the decisions because of the long time necessary for pomological evaluations. The General Inspection Service then establishes mother trees and stoolbeds of the newly selected material. The nurseries also are allowed to start new stoolbeds of virus-free rootstocks but under control of the General Inspection Service. The nurseries, however, have to buy their bud- and graft-wood of virus-free cultivars from the General Inspection Service.

To give an impression of what's going on, some data are presented in Table 3 about the release of apple bud and graftwood in the past season (summer, 1974 and winter 1975). It should be noted that this season there were no virus-free M.9 rootstocks available for budding. (M.9 is the most important rootstock in the Netherlands.) The virus-free buds were therefore budded on other virus-free rootstocks and on virus-infected M.9.

Virus-free M.9 rootstocks are rapidly being multiplied under the control of the General Inspection Service. Some nurseries have started new stoolbeds with all the new virus-free layers that have become available. These stoolbeds are now coming into production

and it is thought that next season all nurseries will have enough stoolbeds of virus-free M.9. Therefore, in 1975/1976, the Dutch nurseries are free to do what they want. Most virus-free M.9 rootstocks will be planted and budded in 1976. It is estimated that at least one million trees on virus-free M.9 will be available in 1977.

Table 3. The release of budwood and graftwood of apple with a different virus content in the season 1974/1975 in the Netherlands. (Data of the General Inspection Service NAKB)

Virus status	Buds	Grafts	Total (%)
Virus-free	980,200	297,800	47.6
Virus-tested	809,600	93,800	33.7
Not tested	192,450	30,100	8.3

Literature Cited

1. Campbell, A.I. 1974. Which Cox clone is the best? Grower 81 (24):1166-67.

2. Oosten, H.J. van. 1974. Virus research and clonal selection in fruit trees. Ann. Rept. Res. Sta. Fruit Growing, Wilhelminadorp, 1973:19-20.

3. Oosten, H.J. van. 1975. Virus research and clonal selection in fruit trees. Ann. Rept. Res. Sta. Fruit Growing, Wilhelminadorp, 1974:17-18

4. Westwood, M.N., and H.R. Cameron. 1974. Effects of vein yellows virus on growth, flowering and yield of Anjou pear. J. Amer. Soc. Hort. Sci. 99:(5):425-427.

****

POMOLOGICAL PARAGRAPH

Dutch small fruit acreage shows an 83% decline since 1950. Increasing labor costs and lack of harvest labor have been responsible for a steady decline in small fruit acreage in the Netherlands. From 1950 to 1973, the acreage decreased from 12,300 acres to a little more than 2,000 acres. The only small fruit crops that have shown an increase are blackberries and blueberries which together total only about 578 acres. It was the opinion of the author that the pick-your-own method of sale warranted serious consideration in the Netherlands.

REFLECTIONS AFTER THE SABBATICAL IN THE NETHERLANDS

William J. Lord
Department of Plant and Soil Sciences

The apple industry in the United States suffered 3 consecutive marketing seasons, starting with the 1969-70 season, of over-supply and low prices. It became clear that in order to survive, the industry must strive for production increases per acre and per man hour without sacrificing fruit quality. Fortunately, production decreased somewhat the last 3 years and returns to growers have been more favorable. However, it is likely that apple surplus years will again occur, and production and marketing costs have increased rapidly since the fall of 1973. Since many of the concepts and techniques used in intensive orchards to increase yields per acre and per man hour were originated or refined in the Netherlands, this seemed a logical place to spend a sabbatical. Now that my sabbatical leave has terminated, it is time to reflect on what I observed, how it might apply to Massachusetts, and ask, "Where do we go from here?"

The Apple Industry in the Netherlands

Research. The Netherlands, which covers an area little larger than the combined areas of Connecticut and Massachusetts, has a National Fruit Research Station at Wilhelminadorp and 7 Experimental Gardens for fruit. Since field research at Wilhelminadorp is frequently duplicated at one or more Experimental Gardens, the time interval between experiments and commercial adoption of useful practices is shortened.

An impressive feature of the research work at Wilhelminadorp is the close liaison and cooperation with growers. Most research is designed to answer questions by growers. A "Wild-Idea Club," composed of researchers and progressive growers, organized by the National Fruit Advisory Service, meets periodically to discuss and implement research on "futuristic" ideas.

Researchers at Wilhelminadorp are presently studying varieties, pruning methods, virus-free varieties and rootstocks, chemical thinning, pollination and fruit set, nutrition, trickle-irrigation, multi-row and full field plantings, growth regulators, integrated pest control, etc.

Modern orchards.[1] The orchard is generally family-owned with no hired labor except for harvest. An orchard of 15 to 20 acres is considered an economical unit for one family when tree fruit are the only source of income.

[1]Dutch apple growing will be discussed in detail at the N.E. Fruit Meetings.

Most orchards are on M.9 rootstocks and most are trained as slender-spindles with 680 to 1200 trees per acre. The minimal frame-work on these trees is a striking contrast to the frame-work on apple trees in Massachusetts. The slender-spindle training system makes a large number of trees per acre possible and this combined with little pruning for the first 4 to 5 years leads to a large quantity of fruiting wood per acre within a few years. Thus, early heavy yields are obtained.

The oldest slender-spindle trees are probably 13 to 15 years of age and it is possible that in some instances, the trees are too closely planted. However, economics have forced growers to be more concerned about producing heavy, early yields than the necessity for early removal of the trees. Furthermore, shorter rotations (the talk is that orchards will be removed after 15 years) will enable the growers to more frequently apply the latest technological advancements in orcharding.

The "modern" apple grower is a perfectionist by our standards, particularly in training his trees, and he excels in production efficiency. Like the American grower, he has "pioneered" many concepts used in fruit growing.

The quality of Dutch apples on the tree is good. However, like the United States, the major problems are in the areas of harvest and post-harvest operations. Most fruit, regardless of grade, is sold jumble-packed in open crates holding 44 pounds of apples. Although the wholesalers are prepared to pay more for cartoned apples, the growers are not convinced that increased returns for cartoned-apples will offset increased packing and packaging costs.

The apple industry is geared to the fresh fruit market and processing is practically limited to making of apple sauce. The Dutch consumer doesn't know fresh apple cider and, thereby, is not willing to pay a higher price for the product that the more economical "bottled" apple juice.

Although 10% of the apples are sold at the farm, this method of sales is much less specialized than in Massachusetts with no roadside stands, consumer packaging, nor sales on Sunday.

In general, packing is decentralized and selling is centralized. Growers store and pack their own fruit, but it is sold through auctions. Too often, the storage is "speculative," the fruit is not stored properly (like in the United States), and the Golden Delicious in the packs are non-uniform in color.

Intensification in Massachusetts

Past. In the 1930's and 1940's, pomologists at the University of Massachusetts had considerable expertise for this era on size-control rootstocks. Based on research at Amherst and several trials

in commercial orchards, it was concluded that M.9 was for the home gardener and M.2, M.7, and M.13 had commercial value along with seedling trees.

Permanent trees on seedling roots were spaced 40 feet by 40 feet (27 trees/A) and the trees were mowed and sprayed from both directions. When filler trees were used in the rows and between rows, tree number increased to 106 trees per acre. However, frequently the loss in productiveness on the trees exceeded the value of the fillers because the filler trees were not removed before crowding occurred.

The introduction of air blast sprayers eliminated the need of applying sprays from both directions and herbicide usage eliminated the need of cross-mowing. Therefore, it became possible to retain the 20 feet by 40 feet (54 trees per acre) plantings on seedling roots or plant seedling trees at a 32-foot by 40-foot spacing (34 trees/A). The increased tree number and reduced orchard travel increased efficiency (higher yields and less cost).

In 1956, we recommended M.7 with no reservations, except for Red Delicious, and planting distances of 20 feet by 30 feet (72 trees per acre). M.13 was suggested for wetter soils. Since the loss of the late Dr. Walter D. Weeks in 1968, size-control rootstocks and orchard intensification has received little or no research emphasis in Massachusetts since it is not possible to investigate every researchable area in fruit growing! Therefore, we had to look to other fruit growing areas for information on size-control rootstocks and orchard intensification and Massachusetts growers did considerable "pioneering" on their own.

The apple industry was subjected to rising production costs and harvest labor difficulties in the 1960's and as a result interest in smaller trees and closer spacing to increase production per acre and per man hour heightened. Since the author was not actively involved in testing rootstocks and planting systems, all he could do was caution and observe. Growers, in the meantime, planted trees on M.7 and MM 106 at spacings as close as 10 feet by 18 feet (242 trees/A) and tree training, in general, involved limb spreading and standard pruning techniques.

The present. Growers have found that dense plantings on M.7 and MM106 are not a guarantee for success. However, we are indebted to these pioneers for we have gained much valuable information from their experiences. Currently, some blocks of young bearing trees are crowded and growers are forced to remove trees to reduce crowding. If the "temporary" trees have paid for themselves and the remaining trees are not adversely affected, the closer spacings were worthwhile.

In 1970, New England Tree Fruit Survey indicated that only 1% of the trees in Massachusetts were on M.9 rootstocks. Interest in this rootstock has increased only slightly in the last 4 years. To the contrary, interest in spur trees, the M.26 rootstock, limb spreading, and summer pruning have increased greatly.

Where Do We Go From Here?

General Comments. We need to increase the yield of high quality fruit per acre and per man-hour in Massachusetts and few will argue against orchard intensification as being an essential step toward fulfilling this goal. However, making the right decisions on degree of intensification, rootstock/variety combinations, training systems and planting systems is difficult, to say the least.

Trees on size control rootstocks produce earlier, and are easier to prune, spray, pick and should produce better quality fruit if the trees are managed properly. Furthermore, research has shown that yield in pounds per square foot of space occupied by the tree is greater for trees on size control rootstocks than those on seedling roots. But, small trees will not produce high yields per acre at an early age nor high life-time yields per acre unless correctly pruned and spaced. In Massachusetts and other fruit-growing areas in the United States, tree crowding has become a serious problem in some intensive orchards because increased tree numbers per acre has not been associated with a comparable decrease in tree size. Furthermore, high yields per acre at early tree ages frequently have not been realized.

Orchard land in Massachusetts is less expensive and more available than in the Netherlands. Many Massachusetts growers have been satisfied with low density plantings and thereby have avoided errors that result in tree crowding. They may continue to follow this alternative in the future! However, all growers should be concerned with earlier returns on their investment and increased production of high quality fruit per man-hour and this need has become increasingly essential with our present economy. However, whatever is done, it is well to keep in mind that our industry is based on red apples for fresh fruit market, and that we cannot sacrifice red color and good keepability for high yields per acre.

Vigorous size-control rootstocks. The Dutch apple industry, at present, is geared to M.9's supported by posts, and the Massachusetts industry to the more vigorous rootstocks and the free-standing tree. We certainly will not abandon our present orchard management practices until we are satisfied that weaker rootstocks, including M.9's, are suitable alternatives to M.7 or MM 106 in Massachusetts. The question then arises, how can we control the size of our trees on M.7 or MM 106 and plant them closer without encountering serious overcrowding problems. Perhaps pruning techniques, other than what we have used in the past, will enable us to do this and to obtain profitable yields earlier.

The slender-spindle pruning techniques used in the Netherlands warrants investigation. The slender-spindles in the Netherlands are not a "pretty" tree, but they are productive! The slender-spindle pruning technique has enabled the Dutch growers to increase yields per acre and per man-hour and to keep their trees smaller. However, the author is not willing to suggest the slender-spindle pruning method other than on a trial basis. Extensive testing is needed and spacings will vary according to variety and soil type. Even though we may use slender-spindle techniques, our trees may look more like the free-spindle trees found in the Netherlands with a heavy frame of scaffolds in the lower third of the trees because of wide spacings. The heavy frame may be necessary to reduce the vigor of the trees on M.7 or MM 106.

Weaker rootstocks. The writer is convinced the proper way to keep trees small is by use of weak rootstocks, more dwarfing than M.7, and not by chemicals. Chemicals can be useful in promoting flowering of young trees and restricting growth but annual applications to keep trees small do not seem practical.

Hopefully, the M.26 rootstock will prove to be a suitably weaker rootstock. There is much interest in M.26 in Massachusetts and elsewhere. However, thorough evaluation of standard trees and spur-types on M.26 at various spacings and training systems is needed under our conditions. The Dutch, even though they have M.9, are also interested in spurs on M.26. A question concerning M.26 is the need of supporting trees on this rootstock. English researchers have found that budding 4 inches higher and then planting 4 inches deeper than in the nursery will stabilize trees of M.26. This procedure warrants investigation under our conditions.

It is difficult for the European Pomologists to understand why we have large holdings of big trees, whereas equivalent yields and profits might be derived from much less acreage with trees on M.9. Furthermore, they are amazed that United States apple growers are content to wait 5 or 6 years for their first "real" crop and to work with such large trees. One European Pomologist stated that the American Fruit Grower has everything going his way because, compared to many European apple growing areas, he has better soils and climate.

I was frequently asked in the Netherlands, "Why aren't you interested in M.9's?" My answer was that our industry at present is not mentally prepared or forced by economics to make such a drastic change and that M.9 hasn't been adequately tested for our conditions. It is best that changes come slowly, but frequently disasters force rapid changes. World War II, the floods of 1953, and the price/cost squeeze of the 1960's certainly were responsible in part for the rapid changes in the Netherland apple industry. We now are faced with a serious price/cost squeeze and we in the United States should give serious thought to present orcharding techniques used in the Netherlands and other countries. Technological advancements during

the last decade with trickle irrigation, herbicides, frost prevention, and virus-free rootstocks, behoove us to take another look at the M.9 rootstock!

Needed research on M.9. The creosote-impregnated posts used to support trees on M.9 in the Netherlands are much smaller in diameter than those commonly used in New England, being only 2 to 2-1/2 inches at the base. The use of creosote-impregnated posts (if economical) or substitutes for wood appears to need investigation under our conditions.

There are 4 virus-free sources of M.9 in the Netherlands which may or may not be different. Growth of trees on these virus-free rootstocks is considerably greater than those budded to virus-infected M.9 rootstocks. The need to evaluate virus-free rootstocks of M.9 under our conditions is obvious.

Slender-spindle techniques need investigation for individually-staked trees on M.9 in Massachusetts. These techniques may induce earlier heavy yields and reduce pruning time in comparison to current pruning practices.

Budding height. Budding height and its effect on tree performance is being investigated in the Netherlands. It is now suggested that budding height on M.9 rootstock be increased by 2 inches (from 4 inches to 6 inches in height). This will reduce the incidence of scion rooting and decrease tree vigor. Budding M.9 and M.26 at heights of 8 inches to 20 inches will cause even greater reduction in tree size than by budding at 6 inches. However, tree variability is increased because of burr knots (adventitious roots on trunks of trees) on M.9 and M.26 rootstocks and variation among rootstocks in form. The burr knots restrict carbohydrate transport to the roots which leads to tree decline. Deeper plantings would allow the burr knots to develop into roots and thus improve anchorage. However, tree vigor is increased. High budding of MM 106 and M.2 rootstocks is of little value for growth suppression in the Netherlands but it does induce better branching. Certainly somewhat higher budding, as being advocated in the Netherlands or more care at planting, should help reduce the incidence of scion rooting in our orchards.

Interstem trees. At present, there is little interest in using M.9 as an interstem in the Netherlands because the trees would be more costly and burr knots on M.9 and variable rootstock form increases tree variability. However, there seems to be considerable interest in the United States in interstem trees and we should evaluate them in Massachusetts.

Pruning. The statement heard in the Netherlands that continually comes to mind is -- orchard size should be g6verned by the number of skilled pruners available on the farm. Those considering high density plantings or even medium density plantings of more than

120 trees per acre on M.7 would do well to consider this statement. These plantings require "tender loving care" and if a grower cannot provide this care nor is willing to make acreage reductions in order to provide this care, it would be best to avoid such plantings.

The Dutch are studying the effects of heading height at planting on tree training. This is particularly important on the 'Boskoop' variety, which like most of our varieties, is not well branched when planted as a 1-year-old. A year or more time can be lost because of corrective pruning of heading errors at planting. Thus, considerable attention is given to heading height in the Netherlands and we would do well to "follow suit." We must pay more attention to training young trees. Perhaps by giving more attention to proper heading heights at planting and by using slender-spindle training techniques, there will be less need of limb spreading. This is true in the Netherlands.

Summer pruning has gained interest in the United States. However, in some instances we may have been pruning too early in the season, particularly when it involved shortening of some current season's shoots. Research in the Netherlands shows that summer pruning should be done after completion of shoot growth. Earlier shortening of shoots causes regrowth on the shortened shoots and the breaking of bud rest on the adjacent 2-year-old wood, which means less flower-bud initiation.

Multi-rows. The Dutch have studied multi-rows extensively and have concluded that, at present, the single-row is preferred. We would do well to rely on their experiences. The double row was of no advantage whereas the even-numbered rows in a 3,5 or 7 multi-row system can be only temporary because tree management and harvest is difficult in multi-row orchards. However, this doesn't preclude the need of continued research with multi-row or full-field plantings because of the availability of M.27, chemical techniques, and new planting techniques.

Equipment. The trend toward smaller sprayers in the United States has reduced the need for large tractors. The orchard tractor used by the Dutch is approximately 48 inches wide and I was told that it is capable of handling 2 bulk bins front and back (a bin full of apples weighs about 650 pounds). Of course the land is flat in the Netherlands! However, small tractors and other equipment that can operate in a 4-foot alley may be feasible in some orchards and thus would premit further intensification.

Summary

Increasing yields over the life-time of the orchard, especially in early years, can be achieved by increasing tree density. Unfortunately, at present, the single-row planting is most practical which is disappointing when one considers land wastage. Multi-row

systems which utilize available space more efficiently than the single-row system are limited by a number of factors such as the high initial cost, tree management, current equipment, and harvest difficulties.

It is impossible for us in Massachusetts to investigate all of the researchable areas mentioned above and there are other problems of concern besides orchard intensification. Furthermore, many of the "proposed" researchable areas are probably under investigation in neighboring states.

Some of the orcharding techniques currently popular are not new but neglected practices of the past. Basically, the young, slender-spindle tree is a non-pruned tree. Years ago, there were numerous experiments comparing pruned and non-pruned non-bearing trees and it was generally concluded that young trees should be pruned. Now we want weak growing trees and early, heavy production in order to maintain them at close spacings. In the Netherlands, they talk about removing orchards after 15 years.

We all could improve present orchard practices by making fuller use of present knowledge and undoubtedly research will continue to show how to improve on present practices. Thus, in this age of rapid change, we should take fuller advantage of the many man-years of study devoted to apple husbandry all over the world.

****

FRUIT NOTES INDEX FOR 1975

(This index of major articles has been prepared for those who keep a file of Fruit Notes. The number in parenthesis indicates the pages on which the item appears.)

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S. MAIL

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 41 (No. 1)
JANUARY–FEBRUARY 1976

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

COST OF PRODUCTION

Robert L. Christensen
Department of Food and Resource Economics

The cost of production is a very popular concept; but not clearly understood. A single value advanced as the cost of production for a product, such as apples, should be viewed with skepticism for several reasons:

1. A cost of production estimate reflects some average or norm situation. If it is based on a representative or "model farm" production situation, it only represents that situation's assumptions. If it is based on a survey of some number of observations, it may be questioned on grounds of representativeness.

   The cost of production estimate resulting from a survey is the result of an implicit distribution of a set of costs of production. Some will be higher than the "average" and some lower. Selection of the average, as a measure to be used for pricing purposes, means that approximately half of the producers would have a cost of production higher than the average and half lower (assuming a normal distribution). What is the equity of such a situation? Should one say that the price should be high enough to cover the costs incurred by the highest cost producer? Would the incentives for gains in efficiency be strong? Most importantly, would such a pricing strategy be acceptable politically and is it consistent with maximization of consumer welfare? Still another alternative might be to propose that the price should be that which favors the most efficient (lowest cost) orchards. Thus, higher cost operators would be stimulated to become more efficient or go out of business. Attrition of orchards would be expected with substantial increases in orchard size. The industry would then become more vulnerable to market changes.

2. Cost of production estimates are the result of a set of direct costs and a set of implied costs. These latter costs include depreciation charges and interest on investment, both of which are somewhat arbitrary and variable from orchard to orchard. In most cases, the cost of production estimate also contains an arbitrary cost assignment for the operator and family labor. These charges are also variable from orchard to orchard depending on the situation and known opportunities available for the family's labor and management.

3. Another problem occurs when the orchard has more than one crop such as apples, pears and peaches. Many equipment items are shared and thus ownership costs must be allocated to the different enterprises in some manner. The method used is usually arbitrary and may be based on the proportionate contribution of each enterprise to gross income or, alternatively, on the proportion of total hours the equipment is used on a given enterprise. A prime example might involve the allocation of storage costs to different fruits or even different varieties of the same fruit. Another difficulty arises in allocating the costs of activities which are not readily attributable to a specific enterprise. It should be evident that the method of allocating shared costs among enterprises will have a substantial effect on the production cost estimate for a given fruit crop.

4. Production costs will vary from orchard to orchard and from year to year. Tree age and/or size, tree spacings, varieties, rainfall, timing of orchard operations, input costs and managerial decisions are factors which vary from year to year. Thus, a cost of production estimate should be identified with the whole complex of factors and assumptions involved.

5. In a production period, the price is determined by the short run supply and demand situation. Economic theory defines demand in terms of prices that consumers are <u>willing to pay</u> for varying quantities of a product. It has no relation to cost of production. Supply is defined as the quantities of the product that individual producers are <u>willing to sell</u> at varying prices.

   The short run supply curve of the individual producer is defined as his marginal cost function. Marginal costs are derived from variable costs, not total costs. Thus by definition, fixed or overhead costs are excluded from the determination of the supply function and, therefore, market price.

Thus, while a figure representing the cost of production for apples may be attractive from a political and policy point of view, it has many shortcomings which make it unreliable for such uses.

The cost-price squeeze on almost all farmers is a very real problem and the seriousness of the situation should be brought to to attention of the public and policy-makers. However, the use of a "cost of production" estimate can easily create a misleading impression and, at worst, result in action that would unwittingly have an undesired effect. Finally, there are alternative approaches

to expressing the problem through indices, balance sheets, and cash flows that mav be preferable, though perhaps less dramatic.

****

REDUCED SPRAYING FOR APPLE INSECTS AND MITES: RESULTS FROM BRITISH COLUMBIA

Ronald J. Prokopy
Department of Entomology

Many, if not most, Massachusetts apple growers feel that they probably apply more insecticides and miticides than actually needed to obtain high yields of high quality fruit. If pesticide applications could be reduced without sacrificing yield or quality, there could be (1) dollar savings in cost of apple production, including savings on cost of spray materials as well as savings on such application costs as time, wages, fuel, and equipment wear; (2) greater opportunity for build up of natural enemies of mites and insects, and therefore, likelihood of even further reduced need for miticide and insecticide application; (3) less selective pressure for the development of resistance to miticides and insecticides, and therefore a longer useful life expectancy of those miticides and insecticides presently used in orchards; and (4) less danger of pesticide residues in the fruit and in the orchard environment.

The question is how to develop a reliable program for reduced insecticide and miticide usage that will succeed in Massachusetts apple orchards. In this and future issues of Fruit Notes, I would like to explore this question. Because Massachusetts has had no recent history of fruit insect and mite research, we must turn first to other states and examine their progress toward this goal. In this article, I want to take a look at a report entitled "Pest Management: Experience in Six British Columbia Apple Orchards," which appeared in the August, 1975 issue of the Canadian Entomologist and is authored by Drs. Harold Madsen, Fred Peters, and Jerry Vakenti of the Canadian Department of Agriculture.

The following is an excerpt from this report. "The number of chemical sprays per (commercial fruit) orchard averaged eight when the study was initiated (in 1972). In 1973, the sprays required for pest control were reduced to an average of 5.6 per orchard, and in 1974, this figure was further reduced to 3.1. This reduction in chemical sprays was accomplished without an increase in insect or mite injury to fruit or foliage."

How was this exciting result achieved? It was achieved primarily by employing techniques for detecting and monitoring popu-

lations of those insect and mite species known to cause injury in British Columbia apple orchards, and by spraying only when those species were found to occur in numbers sufficient to cause economic injury. The species were: codling moth, San Jose scale, fruittree leafroller, thrips, plant bugs, white apple leafhopper, apple aphids, and three species of plant-eating mites. Now, it is true that the apple maggot and plum curculio are not known to occur in British Columbia, and that these are two of our most potentially injurious apple pests in Massachusetts. On the other hand, codling moth and mite injury is usually much more severe in British Columbia than here.

The approach that these researchers used to control codling moth and mites is particularly instructive. To monitor codling moth populations, they utilized sex attractant traps Pherocon ICP type traps, manufactured by Zoecon Corporation, Palo Alto, California). These traps contain a small capsule of the synthetic sex odor of female codling moths, which is a strong attractant for the males. This odor was discovered and sythesized 4 years ago by Dr. Wendell Roelofs and his associates of the New York Agricultural Experiment Station at Geneva. Male codling moths attracted to this odor are captured by a stick substance inside the trap. Dr. Madsen and his colleagues installed these traps at a density of one trap per hectare (about 2.5 acres) of orchard. They advised the growers to apply a spray against codling moth only when the trap catches averaged two or more male codling moths per hectare per week. Previous studies had shown them that virtually no codling moth larval injury to the fruit occurred when fewer than this number of male moths was captured.

By spraying for codling moth only when the traps indicated it was necessary, less insecticide was applied. As a result, certain natural enemies (predators) of the mites were able to survive, and in some orchards began to build up into numbers which, by the end of 1974, were sufficiently great to control the mites without need for any miticide application. It would be a significant advance if we in Massachusetts were able to succeed in reducing the spray program as well as these British Columbia growers have done.

In the next issues of Fruit Notes, I will explore some of the reduced spray programs that are being studied in places closer to home than British Columbia.

****

VARIETIES OF APPLES FOR MASSACHUSETTS

J.F. Anderson
Department of Plant and Soil Sciences

Variety	Recommended for	Harvesting Season
Vista Bella	T	Late July to Early Aug.
Julyred	T	Late July to Early Aug.
Quinte	T	Late July to Early Aug.
Puritan	C & H	Mid August
Jerseymac	T	Mid to Late August
Tydeman's Early	T	Late Aug. to Early Sept.
Paulared	T	Late Aug. to Early Sept.
McIntosh	C	Mid-September
Macoun	C & H	Late September
Spartan	C & H	Late September
Empire	C & H	Late September
Cortland	C & H	Early October
Delicious	C & H	Early to Mid-October
Golden Delicious	C & H	Mid-October
Idared	C & H	Mid-October
Spencer	C & H	Mid-October
Mutsu	C	Mid-October

T = Trial H = Home garden
C = Commercial - Varieties so marked are not necessarily equally adapted to all parts of the state.

Variety Notes

Vista Bella - Ripening in late July, the fruits are of medium size, firm, and have a bright, smooth finish and medium red color. The fruits have very good quality for an apple of this season. The tree is large, vigorous, and productive.

Julyred - An attractive apple of medium size, bright red color and good quality. The fruit handles well for an apple of this season. The tree appears to be productive.

Quinte - A Canadian introduction ripening 7 to 10 days before Melba. Yellow skin overlaid with a red blush. Quinte bears annually but thinning may be necessary to obtain adequate size.

Puritan - An attractive, early, red apple. Fruit of McIntosh type, good quality for its season, though somewhat tart. Tree hardy, vigorous, tendency toward biennial bearing, will pollinate McIntosh.

Jerseymac - An attractive McIntosh type that ripens a month before McIntosh. Fruit color is attractive (80% red), size is above medium, texture is medium-firm, but fruits show bruises easily. Eating quality is good. The trees are annual and productive. Description based on performance in New York.

Tydeman's Early - Often labeled Tydeman's Red. A McIntosh type, ripening in late August. Fruit has green undercolor overlaid with a medium-red blush. May average larger than McIntosh in size. Similar to Rome in habit of growth.

Paulared - Ripens with or slightly later than Tydeman's Early. The fruits are medium to large in size, roundish-oblate in shape and have excellent color and finish. The fruits color very early. The fruit has tended to cluster on our young tree. Production appears to be good.

McIntosh - Fruit is attractive and has excellent quality but bruises easily. Tree is vigorous, hardy, annual and productive. Rogers McIntosh or an equally good red strain is preferred.

Macoun - Fruit of excellent quality, attractive dark red color. Tree has poor structure, is biennial and requires thinning to maintain good fruit size.

Spartan - Fruit has good color and quality but has a tendency to small size. Tree is vigorous and of good structure, annual, will pollinate McIntosh.

Empire - A very attractive apple with full red color, medium size, and very good dessert quality. Empire is annual, and productive.

Cortland - Fruit is attractive, good quality, excellent for salads as flesh does not discolor, very susceptible to storage scald. Tree is hardy, productive, and annual. An excellent pollenizer for McIntosh.

Delicious - Fruit of excellent quality but susceptible to watercore and internal breakdown. Tree is of medium vigor, often biennial and may require thinning. A good pollenizer, Richared or an equally good red strain is preferred. Spur-types are now available.

Golden Delicious - Fruit of excellent quality, yellow, attractive where well-grown. Fruit is subject to russeting. Tree is of medium vigor, biennial and requires thinning to obtain satisfactory size, color and quality. Russet-free and spur type strains are now available for trial.

Idared - Attractive, bright red, winter apple of good quality and size. Suitable for both dessert and cooking. Tree is productive and annual.

Spencer - Fruit is attractive, bright red and has very good quality Suitable for dessert and pie. Tree is hardy, productive and annual.

Mutsu - A Golden Delicious type that is less susceptible to fruit russeting and storage shrivel. Tree is vigorous and productive. Mutsu pollen is triploid and not viable. Fruit size may be too large and susceptibility to Psuedomonas has been noted.

****

EARLY RIPENING APPLE VARIETIES - 1975

J.F. Anderson
Department of Plant and Soil Sciences

This is an update of previous reports on the early-ripening apple cultivars under test at the Horticultural Research Center, Belchertown.

Vista Bella (N.J. #36) - A promising variety that ripens in late July or early August. The fruits are attractive with a bright, smooth finish and medium red color. The medium-sized fruits have a crisp, white flesh and very good eating quality. The fruits have held up well in past years. The tree is large, vigorous and productive.

Julyred - This New Jersey introduction ripens just after Vista Bella. The fruits are of medium size, good red color and a bright smooth finish. The eating quality is good for an apple of this season. The Julyred trees have been productive in our plantings.

Quinte - An Ottawa introduction ripening in late July and early August. The fruits are medium in size and round-conic in shape. The attractive red blush, smooth finish and shape are strong points for this variety. Quinte has shown a tendency to crack around the stem and several growers have reported a susceptibility to blotching (small discolored areas of the skin and tissue immediately under the skin).

Caravel - This Ottawa introduction ripens several days after Quinte. Caravel lacks the appearance and quality of Quinte.

Summerred - We have fruited this British Columbia introduction for five years. The fruits are round-conic to oblong in shape, above medium in size and have a bright red blush. The lenticels are conspicuous and often russeted. The fruits tend to ripen unevenly. The fruit has been harvested in late August in past years, but this year the fruit was picked during the second week of August. Summerred does not appear to be promising under our conditions.

Tydeman's Early (Tydeman's Red) - This English introduction ripens in late August and is similar to McIntosh in appearance but tends to be larger in size. The fruits have a green undercolor and are overlaid with a medium-red blush. The fruit has good quality and looks promising for the early fall trade. The tree is similar to Rome in growth and fruiting habit and production has been fair to good in past seasons.

Paulared - Ripens with or slightly later than Tydeman's Early. The fruits are medium to large in size, roundish-oblate in shape and have excellent color and finish. The fruits color very early. The fruit has tended to cluster on our young trees. Production appears to be good.

****

FRUIT GROWING AND RESEARCH IN SWITZERLAND

William J. Lord
Department of Plant and Soil Sciences

During my recent sabbatical leave, I had the opportunity to visit Switzerland for 9 days to observe its fruit industry, and to talk with Dr. Robert Schumacher and other researchers at the Federal Research Station at Wadenswil. Here are some observations during this brief period.

Fruit growing in Switzerland is an interesting mix of the old and the new. The mountainsides are covered with numerous small diversified farms, each having some sheep and/or cows and frequently several "traditional" trees of apple, pear, or cherry (traditional" trees have long trunks under which the livestock may be grazed or the grass cut for hay). In 1971, there were about 7.5 million of these trees scattered over the mountainsides and valleys of Switzerland. Often these trees are pruned, sprayed with a hydraulic rig and hand gun, and the fruit processed --- apples and pears into cider, and cherries into brandy. An interesting feature of the mountainsides is the espaliered pear trees on the sides of homes and barns.

Cultural practices in the modern orchards are quite similar to those used in the Netherlands, except a lower percentage of the apple trees are on M.9 rootstocks or trained as slender-spindles. The holdings for the most part are small, and the farms are diversified, but farming remains profitable because of government support and because importing of farm products is either prohibited or regulated according to local supply. Thereby, the Swiss farmers receive higher prices for their products than farmers in neighboring countries.

Research: The Swiss Federal Research Station for fruit growing, viticulture and horticulture is located at Wädenswil, which is about a half hour by train south of Zurich and on the edge of Lake Zurich. The research station has laboratory buildings for chemistry, pomology, entomology, plant pathology, microbiology, food technology, growth chambers, and radiation. There are cold storages, greenhouses, a winery and 2 experimental farms at Wadenswil. Five other experimental farms are located in the important cherry, apple, and grape producing areas and there is one farm for the production of virus-free apple rootstocks and scions.

The purpose of the Federal Research Station is to improve agricultural production and the quality of the fresh and processed products through: (a) evaluation of fertilizers, pesticides, growth regulators, and preservation agents; (b) evaluation of cultural and storage techniques; (c) providing nurseries with healthy grapevines, virus-free apple rootstocks and scions, virus-free or healthy small fruits plants, and high quality vegetable seeds; (d) introduction of new varieties; (e) study of technology, microbiology and chemistry of beverages; and (f) providing pure yeast cultures for wineries. All fertilizers, pesticides, growth regulators and preservation agents must undergo tests at Wädenswil and collaborating institutes in Switzerland before they can be marketed.

Fruit research deals specifically with farm management, efficiency, physiology, and nursery and fruit growing techniques. Extensive tests of chemical thinners, varieties, rootstock grafting methods for cherries, walnut propagation, growth regulators, and storage techniques have been and continue to be conducted. The influence of growth regulators on fruit development of sweet cherry, the flowering of apple, on shoot and root development of fruit trees, and the mechanical harvesting of cherries has been studied extensively by Dr. Robert Schumacher and Fritz Fankhauser.

Problems currently receiving considerable attention are calcium (Ca) nutrition of apples, development of biological methods of pest control, and prevention of bird damage. The Ca problem in Switzerland is not caused by the lack of this element, but by an excess potassium (K). There is much adverse public opinion concerning pesticide usage and some individuals have expressed the need for a research station for biological controls. Therefore, the pomologists, whenever possible, are including a treatment testing a biological technique when designing experiments. Bird depredation is serious in small fruit plantings and on early-maturing sweet cherry varieties. To combat this problem, plastic nettings and plastic strips attached to wires which are propelled slowly over the tops of the trees are being tested. Plastic sheets and nettings also are being evaluated to determine their effectiveness in preventing hail damage and splitting of sweet cherries and grapes caused by rain near harvest.

Modern apple orchards: Apples are by far the most important tree fruit crop while peaches and apricots are of minor importance (Table 1). The apple varieties grown in order of their importance are 'Golden Delicious,' 'Jonathan,' 'Gravenstein,' 'Glockenapfel,' 'Idared,' and 'Maigold.' 'Idared' is popular for fresh fruit.

Table 1. Acres of tree fruits in Switzerland, 1974 (hedges and slender-spindles, not including old orchards).

Apples	Pears	Cherries	Prunes	Peaches	Apricots
11,616	2,178	724	464	75	13

'Spartan' and 'Jonagold' are found in some of the newer orchards. When asked about fruit size of 'Spartan,' one researcher said that small fruit was not a problem because trees of the variety on M.9 or M.26 produce larger fruit than trees on vigorous size-control rootstocks or seedling trees.

In general, the new orchards producing fruit for fresh use are on either M.9 or M.26 rootstocks and are being trained as slender-spindles, whereas, the cider varieties mostly are on the more vigorous rootstocks MM.106, M.2, etc., and the trees trained as hedges. (A hedge tree has 2 large scaffold limbs, in the lower part of the tree opposite one another in the tree row, and a central leader. The 2 large limbs are trained horizontally by means of a wire strung along the tree row.)

The trees on M.9 or M.26 may be spaced 4.9 feet to 8.2 feet in the row and 13.1 feet to 14 feet between rows depending on the variety and rootstock combination. These spacings are wider than used in the Netherlands to reduce cost of establishing orchards and to permit tractor travel. (The tractors used on the diversified Swiss fruit farm are wider than those used on the specialized Dutch fruit farm.)

The research station at Wädenswil produces virus-free varieties by heat treatment for the nurseries. This procedure involves growing selected trees of various varieties in a climate chamber at 37° to 38°C for several weeks. The tips of the new growth on these trees are grafted to seedling trees (seedlings are free of all viruses known to occur in apple). Each tip-graft is tested for the absence of virus. This is done by the double budding method with different indicators. The research station increases the supply of virus-free material by establishing "mother trees" which are the source of bud wood for cooperating Swiss nurserymen. Thus, the Swiss apple grower is reasonably sure that the trees purchased from local nurserymen are healthy.

The orchards are grown under sod culture with a strip along the tree row kept free of weeds with herbicides. The Swiss divide the year into 3 seasons in regard to weed control. The first season is post-harvest when an herbicide is applied to control weeds as protection against mouse damage. The second season starts at end of winter when a weed-free area is desired under the trees to facilitate growth and an herbicide is applied if needed. Lastly, the third period commences in late-June when regrowth of annual weeds are desired to compete with the tree for moisture and nitrogen.

NAA and NAAm (Amid-Thin*) are used for chemical thinning but not carbaryl (Sevin*). Carbaryl is not used because it is toxic to bees and it tends to enhance build-up of mites. 'Boskoop' and 'Gravenstein' are chemically thinned only if weather has been very favorable for pollination and fruit set, whereas 'Golden Delicious' almost always requires chemical thinning and follow-up thinning by hand. 'Spartan' are thinned with NAAm applied at 75% petal fall to 1 day past petal fall, and again 10 to 14 days later if necessary.

The apple growers in the main fruit regions of Switzerland apply, on the average, 15 fungicide and pesticide sprays per season. However, it may be possible to reduce the insecticide sprays in half by monitoring insect populations, especially those of codling moths and summer fruit tortrix moths (Adoxophyes reticulana). The primary pests are powdery mildew, scab, and codling moth. However, codling moths are not particularly injurious in well-sprayed orchards as is the case in Massachusetts. Rosy apple aphids, green apple aphids, and red mites are considered secondary pests although the author observed rosy apple aphids to be much more abundant than in Massachusetts. Much time and money is being spent on experiments with intergrated pest control.

Like Massachusetts growers, the Swiss are primarily concerned with nitrogen and Ca levels. Four applications of calcium chloride, as separate applications, 9,7,5 and 3 weeks before harvest, is the general recommendation for reduction of bitter pit. Late Ca sprays are more effective than earlier sprays but applications closer than 3 weeks before harvest are not made because of public concern --- it is easy for the public to keep a watchful eye on spray practices on small farms interspersed with villages.

Ethephon has been researched but its use is not permitted. Alar-85* is used on apple trees to increase fruit set and enhance flower bud initiation, suppress vegetative growth and control preharvest drop. Fruit set is increased with 1500 to 2000 ppm of this growth retardant applied at full bloom. Shoot growth is suppressed and flower bud initiation enhanced by 1500 to 2500 ppm Alar-85*, the concentration depending on the variety, applied when the current season's growth is 8 to 10 inches long. Preharvest drop is a problem with only 'Gravenstein' and to minimize drop, Alar-85* is applied 60-70 days prior to harvest.

*Trade name

On cider varieties, Alar-85* may be applied to the upper parts of the tree to suppress vegetative growth and encourage flower bud initiation and this can be accomplished with a minimum of fruit size suppression. It is suggested that the spray be applied within 2 to 4 weeks after full bloom at concentrations of 1500 to 2500 ppm.

Most orchards are small, therefore, the apples are stored in commercial storages or by cooperatives which grade, pack, and sell most of the apples. The use of scald control compounds is prohibited.

More than 50% of the fresh market apples in Switzerland are stored in controlled atmosphere (CA). 'Golden Delicious' are stored at 1-2°C and in atmospheres of 4% CO_2 and 3% O_2. The other varieties are stored at 4°C and 3% CO_2 and 3% O_2. In these rooms, the CO_2 level is regulated by activated charcoal scrubbers, as they are in the Netherlands.

Fifty per cent or more of the Swiss apples and even a higher percentage of the pears are processed into cider products, of which the Swiss can be justly proud because of their high quality. The cider products produced in Switzerland are: (a) fresh apple juice made by the grower for immediate sale in the fall; (b) carbonated apple juice; (c) a mixture of apple juice and mineral water; (d) turbid apple juice (not filtered, no CO_2, but pasteurized); (e) mixtures of apple juice and other fruit juices; (f) apple wine; and (g) concentrated apple juice. Alcohol is made from the cider apples in large crop years, mainly from the apples produced in traditional orchards.

Packing and marketing. The majority of the fruit is packed in consumer units (poly bags and overwrapped trays) and marketed by the cooperatives. This procedure contrasts to that in the Netherlands where fruit is sold in wooden crates through auctions. Furthermore, the consumer wants a "yellow" 'Golden Delicious' rather than a "green" 'Golden Delicious' which is popular on the German market.

Apple prices are set yearly by individuals representing the growers, the cooperatives, and the Swiss government. For example, the agreed price to growers for 'Gravenstein' in 1974 was approximately 20 cents and 14 cents per pound for Class I and Class II fruit respectively. Class I and Class II 'Golden Delicious' were priced 17 cents and 12 cents per pound, respectively.

****

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S. MAIL

BULK THIRD CLASS MAIL PERMIT

Available to the public without regard to race, color or national origin.

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 41 (No. 2)
MARCH–APRIL 1976

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

STRAWBERRY GROWING IN THE NETHERLANDS

William J. Lord
Department of Plant and Soil Sciences

Growing strawberries in the Netherlands has become a very interesting but complex operation, because it employs a variety of techniques that result in the production of fresh berries from April until the first frost in the fall. To accomplish this, the Dutch produce strawberries under cold frames, under plastic tunnels, in moveable greenhouses, in fixed greenhouses (both heated and unheated), as well as in the field.

From 1950 to 1960, total strawberry plantings underwent an increase from 8,958 acres up to 12,208 acres in response to a high demand and favorable prices for this fruit. However, since 1960, rapidly increasing labor costs and increasing competition from other countries have forced a drastic reduction in acreage until in 1974, only 6,083 acres of strawberries remained. Distribution of this acreage among production styles is shown in Table 1.

Table 1. Acreage of strawberries ripened under field conditions or under glass or plastic tunnels in the Netherlands, 1974.

Field ripened	Ripened under plastic tunnels or cold frames	Ripened in heated greenhouses	Ripened in cold greenhouses
(acres)	(acres)	(acres)	(acres)
5683	135	165	100

These berries are grown mainly in southern Netherlands, and about 60% of the crop is processed. Competition for Dutch berries has come primarily from Italy, Belgium, and Poland. The field-grown strawberries from Italy are as early, and less costly to grow, as those grown and ripened under glass or plastic tunnels in the Netherlands. The Belgium market was lost because growers in that country increased their acreage of strawberries grown and ripened under plastic tunnels. Poland has become a strong competitor especially with field-grown strawberries for processing.

Growing under Mobile Greenhouses, Cold Frames and Plastic Tunnels

Harvest of strawberries can be advanced by growing and ripening the berries under greenhouses, cold frames and plastic tunnels. The Dutch employ all these techniques. However, use of mobile greenhouses has now been largely replaced by use of the more economical

and mobile plastic tunnels; and the mobile greenhouse technique will not be discussed here.

Plants scheduled to be covered by cold frames or plastic tunnels are planted in the field in late July or early August. These are rooted runner plants from growers own propagation fields[1], from a nurseryman, or from cold storage. Plants from cold storage are planted a month earlier than fresh-dug plants. Cold storage plants, which were dug and stored the previous winter, produce flower buds which must be removed. Otherwise, the flowering would restrict plant growth, and an extra month of growth would then be needed to produce plants equal to those produced by rooted runners freshly dug from propagation beds. Although the use of cold storage plants is more expensive, they frequently produce bigger plants and the fruit quality is better because they produce fewer (but sufficient) flowers.

In late December or early January (earlier when there is a threat of frost), the cold frames are placed over the strawberry plants to protect them against frost, wind and other unfavorable weather conditions. This procedure advances harvest about 3 weeks. There is more danger from frosts under plastic tunnels than under cold frames. Thus, the plastic tunnels are not placed over the plants until late February or early March. They advance harvest about 10 days.

Harvest advancement under cold frames and plastic tunnels is slight in comparison to heated greenhouses. Therefore, production of plants with shortened flower and leaf stems because of insufficient day-length and low temperatures is of no concern. If plants do develop with shortened flower and leaf stems, they are less productive, and this is of concern where heated greenhouses are used.

The fruit ripened in cold frames and under plastic tunnels are lighter-colored and softer than fruit of the same varieties ripened in the open field.

Growing in Fixed-Greenhouses

Prior to planting in the greenhouse, the soil is fumigated to prevent the transfer of soil-borne diseases to strawberries from

---

[1]Virus-free plants are frequently multiplied in propagation fields by the growers. The grower may have his own field or with other growers maintain a "collective" propagation field. Propagation fields also are used as a source of runner plants for production fields and "waiting beds." "Waiting beds" are special plants that receive the best possible care in order to grow large plants with numerous roots. Plants from waiting beds are used in greenhouses.

previous crops such as tomatoes. It is desirable not to plant before mid-November and to keep the temperature as near 32°F as possible for several weeks since early planting and high temperatures will produce premature flowering and low quality fruit. The plants used are from waiting beds (described in footnote 1) being either freshly dug or first subjected to cold storage.

Sheets of white plastic (Figure 1) or black plastic are placed on the soil prior to planting and the plants are set through this material. White plastic in comparison to black plastic will delay harvest about 4 to 7 days, but yields may be 10 to 15% higher because of the light reflected by the plastic. However, rots are more of a problem when white plastic rather than black plastic is used because of moisture condensation.

Fig. 1. The 'Glasa' variety of strawberries in greenhouse mulched with white plastic which advances harvest. (Courtesy of Wilhelminadorp Research Station)

Growers generally have several greenhouses, or one greenhouse with sections. A greenhouse or section of a greenhouse may be either heated and illuminated, heated, heated but started on a different date in each greenhouse or section, or non-heated. Two or more of these procedures are generally followed to spread the harvest season.

In the early-house or section, heat is started about January 10th and the plants are illuminated because natural daylight is too short for the development of long flower stalks. Gas (usually) or oil is used for heat. It is risky to force growth earlier than the beginning of January because of possible reductions in yield and fruit quality due to low light intensity.

Fortunately, the illumination period can be other than at the end of the natural day, because electric rates are higher at this time than at night. In fact, growth response is greater from short periods of illumination at night than from a continuous period of illumination at the end of the natural day. Illumination for 15 minutes each hour from 11:00 P.M. to 7:00 A.M. is sufficient and is practiced. Eight to 10 watts of light per square yard is sufficient to form long leaves and flower stalks. However, the light intensity is too low to produce growth comparable to that obtained during the day. Light on a clear winter day is about 100 times brighter than that supplied by the artificial light. Thus, even when illumination is used, the plants need the duration and intensity of daylight for the manufacture of food and to produce vigorous growth. The artificial light does have an influence on the utilization of daylight. Early, heated but non-lighted plants have leaves with short stalks whereas early, heated, illuminated plants have longer stalks and larger leaves. Thus, because of a greater photosynthetic surface, artificially illuminated plants produce earlier and higher yields than non-lighted plants.

Harvest of early, heated, illuminated plants starts in late March. The berries are picked at least twice a week into aluminum boxes. On April 2, 1975, growers received $1.29 to $1.71 per box containing 0.44 pounds of strawberries. A week later, due to increased supply, growers received $0.73 to $1.06 per box of berries of the same quality.

Varieties differ as to when artificial light is no longer necessary in a heated greenhouse. Some varieties can be forced in early February without illumination. Thus, in February, plants may be grown in either a heated, non-illuminated greenhouse or a non-heated house. The plants develop somewhat more quickly and fruit earlier in a non-heated greenhouse than in a cold frame.

Field-Grown Strawberries: June-Bearing

Plants and varieties. About 10 million plants are sold annually by the Dutch nurserymen. Of these, 75% are sold in the summer and 25% in the spring. The plants sold in the summer are used by growers for propagation beds and summer planting of production fields (Figure 2). The plants delivered in the spring are mainly for home gardeners and export. About 30 virus-free varieties are being grown by Dutch nurserymen, but none of these varieties are grown in Massachusetts.

It is possible to harvest June-bearing strawberries, grown in the field by ordinary procedures, from early June to late July. The early-maturing 'Regina' variety, if mulched with black plastic, can be harvested in early-June in southwestern Netherlands. 'Talisman,' a late-maturing variety, when planted on heavy, late soil in the middle of the country, can be harvested from late June through late July.

Soils. Like Massachusetts, strawberries are grown on a variety of soils but permeable soils with good moisture-holding capacity are preferred. Often it is necessary to grow strawberries on the same land for many years and in these situations, soil fumigation is beneficial because of the adverse effect of soil nematodes on plant growth and fruiting. Generally, the soil is fumigated at least once in 2 years. After fumigation, there is a 6- to 8-week delay before planting.

Fertilization. Manure is still used extensively for fertilization of strawberries. This is applied at the rate of 25 to 35 tons per acre; if poultry manure is used, half this amount is sufficient. Farmyard manures are supplemented with commercial fertilizers (complete or nitrogenous) at planting and/or during the growing season.

Planting. The plants are generally freshly-dug from a propagation bed and set in late July or early August, depending upon variety. The planting distances are generally 13 inches in the row and 40 inches between rows. Double rows with plant spacings of 13 inches by 22 inches with 38-inch alleys also can be seen. Sprinkler-irrigation is indispensable with summer planting.

Pest and weed control. Gray mold, blossom weevils, wireworms, red mites, red stele, and verticillum wilt are insect and disease problems which concern the Dutch strawberry grower. Control methods and those for weeds are, in general, similar to those used in Massachusetts.

Winter protection. Mulch is seldom applied for frost protection in winter but there are times when 2.5 to 3.0 tons of straw per acre would be beneficial. However, straw is applied in the spring to keep the berries cleaner.

Advancing or retarding harvest. Harvest can be advanced 3 to 5 days by planting through black plastic and 10 days by covering the plants with plastic tunnels. Harvest can be retarded 7 days by an application of mulch in early winter and its gradual removal as growth starts in the spring.

Harvest and sale. For fresh consumption, the berries are picked with the calyx, and for processing, they are picked without the calyx. Berries for fresh market are harvested into veneer baskets, 8 to a flat. The majority of the berries, both for fresh consumption and processing, are sold through auctions.

Harvest of June-bearing varieties year of planting. In one area of southern Netherlands, growers are fruiting June-bearing varieties in August and September of the year of planting because the soil is too sandy and the soil temperature too high for satisfactory yields of everbearing strawberries. The productivity of cold-stored, June-bearing varieties, when grown as a late-summer crop, is higher than that of everbearing strawberries under these conditions.

Harvest of June-bearing varieties in the year of planting requires the use of cold storage plants, and a deviation from ordinary cultural methods used in the Netherlands. The plants are dug from a waiting bed when they are completely at rest. This occurs between mid-December and the end of February. However, research has shown that January is the best time for digging. The plants are dug, cleaned, and then packed in plastic-lined boxes and stored at 26.6 to 30.2°F. Generally, the production field is planted in early June because later plantings are less productive. Harvest starts 7 to 8 weeks after planting and lasts 3 to 4 weeks, depending upon weather conditions.

Everbearing Strawberries

General. Although the cultivation of everbearing strawberries has been known for years, until 1960 they were grown only by home gardeners. In 1960, the 'Repita' and 'Revada' varieties were introduced by the Institute for Horticultural Planting Breeding (IVT), Wageningen, Netherlands, and these became the foundation of a commercial industry. 'Revada' was especially successful in the North Holland Province. The fruit quality and yield of these everbearing varieties are only moderate, but due to lack of competition, the favorable prices made them profitable. In 1969, the IVT released 2 new everbearing varieties which had better fruit quality and were more productive than 'Repita' and 'Revada.' These varieties were named 'Ostara' and Rabunda.'

Cultivation. Everbearing strawberries are planted in April. Runner plants are either taken directly from the propagation bed or first grown in a greenhouse or cold frame to give them an early start. When giving the plants an early start, the rooted runners

Fig. 2. A production field of 'Senga Sengana' variety in early-June. The field was planted in late-July of the previous year. (Courtesy of Wilhelminadorp Research Station)

are planted into plastic pots or small baskets of 3 to 4 inch diameter in December or January and placed in a greenhouse or under cold frames. They also might be planted "loosely" in the greenhouse in 4 inches of peat or potting soil. About mid-April, these plants are transplanted into the field. The procedure of starting the plants under glass advances harvest by 10 to 16 days thus lengthening the harvest period of everbearing strawberries.

Removal of flower clusters and runners. It is desirable to begin the harvest of the everbearing plants when the harvest of the June-bearing varieties is completed. Thus, the first flowers on the everbearing plants are removed. For plants started under glass, flower cluster removal is necessary before transplanting. When harvest is scheduled to start about July 10, the blossoms are removed until the end of May. Runners are removed until harvest.

Harvest. The harvesting period of 'Ostara' and'Rabunda' is from mid-July to the beginning of October. In North Holland, the 'Revada' variety is harvested from mid-August to late October and in the middle and the southern part of the country, it is 10 to 12 days earlier.

The berries are picked once every 5 to 7 days depending upon weather. Only the first 4 to 6 berries from a cluster are harvested and then the cluster is removed, because the rest of the berries will be too small and their presence will delay the formation of new flower clusters. In a field of well-grown plants, about 2.2 pounds of berries can be harvested per plant. The fruit is sold for fresh consumption in boxes holding about 0.55 pounds of fruit.

Summary

The strawberry industry has suffered because of competition from other countries where harvest is earlier and/or the berries can be produced at less cost. Therefore, the Dutch strawberry grower must be a perfectionist and as efficient as possible to survive.

Striking differences exist between the Netherlands and Massachusetts in regard to planting season and techniques used to advance or delay harvest, and method of sale. Berries are harvested from April until the first heavy frost in the fall; April, from heated greenhouses; May, from cold greenhouses; early June, from cold frames and plastic tunnels; mid-June to early July, from June-bearing varieties; late July to early September, from June-bearing varieties from cold storage; and after early-August to frost, from everbearing varieties.

The majority of fruit produced for fresh fruit use is sold through auctions and about 60% of the total production is processed. Strawberries in Massachusetts are produced for the fresh fruit market and the majority of these are sold by the "pick-your-own" method of sale. This method of sale also warrants investigation in the Netherlands.

****

REDUCED SPRAYING FOR APPLE INSECTS AND MITES: RESULTS FROM MICHIGAN AND NORTH CAROLINA

Ronald J. Prokopy
Department of Entomology

In the last issue of *Fruit Notes*, I discussed an article by Dr. Harold Madsen and colleagues wherein the number of sprays in orchards in British Columbia, Canada was reduced from 8 in 1972 to 3 in 1974 without increase in insect or mite injury to the fruit or foliage. This spray reduction was made possible by employing techniques for detecting and monitoring populations of those insect and mite species known to cause injury in British Columbia apple orchards and by spraying only when such species were found to occur in numbers sufficient to cause economic injury.

In this issue of *Fruit Notes*, I will discuss reports on reduced spray programs for mites in Michigan and North Carolina. The reports are by Drs. Brian Croft and George Rock, respectively, and appeared in the recently published proceedings of a symposium on integrated control of orchard pests held in Bolzano, Italy in September, 1974. Both reports show how it has been possible to

reduce or completely omit miticide sprays in Michigan and North Carolina apple orchards without buildup of plant-feeding mites (red, two-spotted, and apple rust mites).

How was this achieved? First, it was established that populations of plant-feeding mites begin to cause injury when they reach a level of 15 or more per leaf. If there are fewer than 15 mites per leaf, then no detectable injury results from their presence. In abandoned or unsprayed orchards, plant-feeding mites are scarce, and rarely or never reach the economic threshold level of 15 per leaf. One of the reasons why they are scarce in abandoned orchards is that they are eaten by predators, which are abundant in unsprayed trees.

When organic insecticides were first used in apple orchards, plant-feeding mites were not troublesome. The reason was that the insecticides killed both the mite predators and the plant-feeding mites. However, the plant-feeding mites rapidly began to develop resistance to insecticides, and subsequently to miticides. The ecology and behavior of mite predators is not the same as that of plant-feeding mites and their resistance to pesticides was slow to develop. Consequently, few mite predators were able to survive in commercial orchards and plant-feeding mites became a major problem.

What Croft and Rock have found is that certain species of mite predators in Michigan and North Carolina orchards have now become resistant to or tolerant of certain insecticides. When they employed these particular insecticides selectively and at the proper time, the need for miticide usage was greatly reduced or completely eliminated without buildup of plant-feeding mites to the economic threshold. The insecticide-resistant mite predators did the job.

In these and other publications, Croft and Rock are careful to emphasize that maintenance of a sufficient number of insecticide-resistant mite predators in the orchard is a very delicate operation. It usually requires the continuous presence of at least a few plant-feeding mites as a source of food for the predators, and the balance can be upset by even minimum use of an insecticide or miticide harmful to the predators. Certain fungicides and herbicides also were found to be toxic to the predators and could not be used in the integrated control orchards.

Can we apply the findings of Croft, Rock, and others, who studied integrated pest control, to Massachusetts orchards? Yes, we hope so - but first we must do some research. We need to survey which species of mite predators occur in our abandoned orchards. This will tell us which predators thrive naturally in our state. Then we need to survey our commercial orchards to determine which of the naturally occurring predators, if any, have developed resistance to which insecticides. In Michigan and North Carolina, the predominant insecticide-resistant predator of plant-eating mites in apple trees is a predacious mite called *Amblyseius fallacis*.

In Western New York, it is a predacious mite called *Typhlodromus pyri*. In Pennsylvania, it is a ladybird beetle called *Stetorus punctum*. The degree of resistance or susceptibility to a given insecticide (for example, carbaryl) varies greatly between these types of predators and between localities for the same predator. Also, the comparative innate effectiveness of each of these 3 species as predators is not the same, *A. fallocis* apparently being the most efficient.

It is entirely conceivable that in our survey we might find one or more species of mite predator already abundant in certain commercial orchards where growers have been using a certain type of spray program, but a different species of mite predator of greater or lesser innate effectiveness in certain other orchards where growers have been using a different type of spray program. It is also likely that in still other orchards (perhaps most orchards) few or no mite predators now exist owing to type of spray program used.

We will initiate, this spring, a study of the relative abundance of mite predators and plant-feeding mites in various abandoned and commercial apple orchards in Massachusetts. If we can be as successful in our study as Croft, Rock and others, then not immediately but perhaps within a few years' time it may be possible for us to recommend a type of insecticide-fungicide-herbicide spray program that will substantially reduce or possibly even eliminate the need for miticide sprays in our commercial orchards.

Mr. Robert Hislop, who has worked extensively on plant-eating mites and has just received his Master's degree from the University of California at Riverside, has now joined our staff in tree fruit extension entomology and will be focusing his attention on this aspect of our fruit extension program. We look forward to cooperating with Massachusetts fruit growers in this venture.

****

RECENT STRAWBERRY INTRODUCTIONS

J.F. Anderson
Department of Plant and Soil Sciences

Darrow This early ripening disease-resistant variety was introduced cooperatively by the United States Department of Agriculture and the Maryland Agricultural Experiment Station in January, 1974.

Darrow is resistant to five races of red stele root rot and intermediate in resistance to verticillium wilt. Its leaves

are moderately resistant to mildew, leaf spot and leaf scorch.

We fruited Darrow in our variety trials at the Horticultural Research Center in 1972, 1973, 1974 and 1975. The berries are medium to large, firm, glossy, and have good red color. The flesh is firm and has a uniform red color. The primary berries tend to be rough but secondary and later berries improve in symmetry and shape. The plants have shown moderate vigor and moderate runner production in our trials.

Earliglow Another early ripening disease-resistant variety introduced cooperatively by the United States Department of Agriculture and the Maryland Agricultural Experiment Station. Earliglow was introduced in January, 1975. Earliglow is resistant to five races of red stele root rot and to verticillium wilt. Its leaves are moderately resistant to leaf spot and leaf scorch, but only partially resistant to mildew.

We fruited Earliglow in our variety trials at the Horticultural Research Center in 1974 and 1975.

The fruits ripen with Darrow and about 2 to 3 days after Earlidawn. The berries in our trials have been medium to large in size, conic shape, symetrical, medium to dark red in skin and flesh color. The berries are firm and have good flavor.

Delite A late ripening strawberry variety that was introduced cooperatively by the United States Department of Agriculture and Southern Illinois University in 1974. We fruited Delite in our 1972 and 1974 trials.

The plants are very vigorous and produce runners freely. The plants are resistant to 5 races of red stele and highly resistant to verticillium wilt.

In our trials, Delite has produced a medium to large, long conic to long wedge-shaped berry. The bright red berries have good gloss, firmness and flavor. Delite would be worthy of trial where a late, disease-resistant variety is desired.

Yield comparisons for these and several other varieties are shown below.

	Calculated yields-quarts/acre		
Variety	1975	1974	1972
Sunrise	7,195	-----	-----
Darrow	7,376	6,302	3.267
Earliglow	7,289	7,260	-----
Redchief	11,456	-----	5,699
Midway	10,418	10,941	-----
Delite	-----	11,834	6,316

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S.MAIL

BULK THIRD CLASS MAIL PERMIT

DR. WM. J. LORD
PLANT & SOIL SCIENCES
FRENCH HALL

FN

01002

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 41 (No. 3)
MAY–JUNE, 1976

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

IMPORTANT MASSACHUSETTS HIGHBUSH BLUEBERRY INSECTS

William E. Tomlinson, Jr.
Cranberry Experiment Station, East Wareham

Cultivated highbush blueberries are subject to the attacks of many insect pests, of which some of the more damaging can seriously reduce production or adversely affect the marketability of the crop by their presence in the berries when picked. Growers should be familiar with the different pests, their potential for harm to the crop or plant, and the control methods that can be used against them.

During the pruning operation is an ideal time to be on the watch for insect stem galls, stem borers, and scale insects. Insect stem galls are hard, kidney-shaped callus tissue deformations of blueberry twigs and stems. Galls vary considerably in size, depending on the number of gall wasp larvae they contain. They may be numerous enough to reduce the fruitfulness of a bush if not controlled. The galls are formed when the small black wasp lays her eggs in the soft new wood. The eggs hatch and form cells in which the larvae feed. A secretion given off by the larvae apparently causes the formation of the galls. The larvae overwinter in the galls, change to pupae, and transform to adults within the galls in the spring. The adult wasps emerge from the galls at the time twig and stem growth is underway. Removal of galls any time they are noticed, but not later than during winter and early spring pruning is all the control necessary. Be sure to destroy the galls or remove them far enough from the planting to insure that there is no chance of wasp emergence to reinfect new growth.

Stem borer is a beetle grub that tunnels in stems of blueberry. Flagging of shoots in mid-summer is the first sign of borer attack. Examination reveals 2 parallel rows of punctures about half an inch apart girdling the stem several inches from the tip. An egg is laid just under the bark between the rows of punctures by the stem borer beetle. The grub that hatches tunnels in the stem for 3 years before producing an adult beetle. The first year the grub tunnels only a few inches but the second year it may tunnel the whole length of the stem down to the crown. The third year it may start to tunnel up another stem from the crown before transforming to an adult in July or August.

The beetle is slender, about 5/8 of an inch long, yellow, with dark antennae nearly as long as the body. The wing covers are yellow with black edges. The grub is also yellow, attaining a length of about 5/8 of an inch when full grown. Pupation occurs in the tunnel in a cell plugged with sawdust.

The flagged tips, the weakened appearance of infested stems during the growing season and the emission of elongate yellow frass

pellets aid in the detection of stem borer infestations in all seasons.

Removal of flagged tips below the girdling punctures or removal of stems below signs of tunneling controls this pest. If the grub is in the crown, it should be probed for with a wire or slender twig.

There are several species of scale insects that may attack blueberry. Putnam scale has been the most commonly troublesome on cultivated highbush blueberry. This is a small round scale with a grayish covering that hides the yellow scale beneath. It most commonly settles under loose bark on older canes where it may form encrustations resembling the bark itself. In heavy infestations, scales may settle on young stems, leaves and fruit, causing circular red spots where they settle.

Regular removal of older, low producing canes during pruning helps to prevent Putnam scale infestations from developing to serious proportions. A dormant application of a 3% concentration of superior oil to thoroughly wet all parts of the bush controls Putnam scale or any other scales that may be present.

In the early spring, small, dark reddish brown beetles may be found feeding on expanding blueberry fruit buds. These are cranberry weevils, also an important pest of cranberry as the name indicates. If disturbed, the beetles usually drop from the bud so that the holes they have drilled in unopened blossoms as they feed and lay eggs may be the most obvious sign of their presence. The beetles are about 1/16 inch long with a slightly curved beak which is about half as long as the body. A single egg is laid among the stamens in unopened blossoms in a hole drilled for that purpose by the female. Blossoms that contain an egg are partly severed from the stem, turn purplish, do not open and eventually drop from the bush. Pupation takes place in the hollowed-out blossom. The new brood of weevils emerge in late June and early July, feed on blueberry leaves and soon go into diapause in the litter in the field. They cause serious crop reduction when abundant, and infestations persist for years unless controlled.

At present, there is no insecticide labeled for control of cranberry weevil on blueberry. Clean cultivation affords some control, but most Massachusetts plantings are in sod or mulch.

Sometimes present with cranberry weevil are 2 other snout beetles: the currant fruit weevil and the plum curculio. Currant fruit weevils are about the same size as cranberry weevils, but are light brown in color and possess a shorter and stouter beak. Plum curculio is a dark brown and black snout beetle about 1/4 inch long.

There are lighter brownish, yellowish and white scales forming bands on the body and wing covers as well as several raised humps or crests on the wing covers that give them a rough appearance.

Currant fruit weevils lay their eggs in or near the stem of newly set blueberries. Plum curculio eggs are laid in crescent shaped cuts in the skin of the berry made by the female. The larvae of both species are white legless grubs that feed in one berry only. Infested berries turn prematurely blue and shrivel. Not only can these 2 beetles seriously reduce the crop but their larvae may spoil early pickings by their presence in the pack.

Guthion is labeled for control of plum curculio on blueberry. If plum curculio is abundant or has been a problem previous years, apply it just prior to bloom and repeat when about 75% of the blossoms have dropped on late varieties. If cranberry and currant fruit weevils are present, Guthion will also control them.

Cranberry fruitworm and cherry fruitworm infect green blueberries, not only causing serious crop reduction, but also appearing in large numbers in early picked fruit where they become a problem when they emerge and crawl around under the cellophane or inside the refrigerator.

Cranberry fruitworms spend the winter as full-grown larvae in cocoons near the surface of the soil under the bushes. The larvae pupate about the time the bushes are starting to bloom and the moths emerge from the time early varieties start to set fruit until after late varieties have set. The moths are black, tinged with reddish and white scales. They have a wingspread of about 1/2 inch. The forewings have a patch of white scales near the base and another larger one toward the apex. Moths lay eggs singly in the calyx of the small green berries. The eggs hatch in about 5 days and the worms enter berries to feed on the seeds and pulp. The larvae form clusters of berries into a frassy web as they feed, destroying several berries before they are through feeding. The mature larvae are green, tinged with red on the back, and measure about 1/2 inch in length. When through feeding, the worms drop to the ground and spin their cocoons in which they remain until the following spring.

Cherry fruitworms also spend the winter as a full grown larvae, but in tunnels that they made in dead pruning stubs on the bush or in dead weeds. Pupation takes place in the tunnels in May about the time bushes are in bloom. Moths emerge and lay eggs on the berries and leaves in late May and June. Moths are dull blackish with gray and brown bands on the wings and have a wingspan of only about 5/16 of an inch. The eggs are circular, flat and nearly colorless. They hatch in about a week, enter a berry and feed on seeds and pulp. They do not form clusters together and feed on only 1 or 2 berries. Full grown larvae are bright orange red and measure about 1/4 to 5/16 of an inch long. In heavy infestations, 2 or 3 dozen larvae per pint of berries is not uncommon.

Several insecticides are labeled for control of cranberry and cherry fruitworms on blueberry. Two or 3 applications of carbaryl (Sevin*) or malathion are recommended and labeled for their control. Guthion and parathion are also labeled but should not be used unless all safety precautions are scrupulously followed.

Blueberry maggot or fruitfly is closely related to the apple maggot. It is primarily a pest of ripe berries in contrast to cranberry and cherry fruitworms. Winter is spent in the pupal stage close to the surface of the soil. Flies emerge from the puparia from late June until late in the summer. The flies are black with characteristic black bands on the wings and are about the size of horseflies. About a week or 10 days after emergence, flies start to lay eggs. Ripe or nearly ripe berries are preferred, but they will lay eggs in green fruit when abundant or when ripening fruit is absent or scarce early in the summer. Eggs are inserted just under the skin of the berry. These hatch into tiny colorless maggots in about 5 days and feed in the berry for about 3 weeks. They first feed and soften the center of the berry, but as they grow, they feed within the entire berry, turning the contents into purple juice and seeds. Full grown maggots are white and about 1/4 inch long. When through feeding, the maggots drop to the ground and form puparia in which they remain until the following growing season. In fact, they have insured their survival in case of crop failure, by delaying the emergence of a small percentage of flies from their puparia until the second of even the third growing season after they entered the soil.

Maggot control is complicated by the long flight and egg laying period of the flies and by the fact that infestation occurs during the picking period. This calls for several applications of a short-lived, low toxicity insecticide. Malathion sprays or dusts every 10 days beginning about July 4 are safe, effective and short-lived enough to not interfere with the harvest schedule. In fields where maggot has been difficult to control, applications every 7 days may be necessary for adequate control.

Japanese beetles may cause injury when they congregate on the ripening berry clusters to feed. They score the berries, which then shrivel and become worthless. Beetles also feed on tender terminal leaves, leaving them a network of veins. The latter injury can be important in heavy infestations. Carbaryl (Sevin*) sprays or dusts, applied as necessary, are recommended for Japanese beetle control.

Present occasionally during the summer on individual bushes or branches may be Datana worms and fall webworms. Datana worms feed in colonies of many individuals with no web or nest. When the worms are large, they can strip a branch or small bush almost overnight, it seems. The full grown caterpillar is about 2 inches long with a dark head and body, a yellowish neck and yellow stripe running the length of the body. When disturbed, the worms raise

*Trade name

their heads and anal segments in a characteristic alert pose. Fall webworms also feed in colonies of many individuals, but enclose their feeding area in a web. The mature caterpillar is about an inch long and covered with white hairs. To control these worms, remove the colony and destroy it. A heavy foot works well. Don't waste insecticides on them.

****

GETTING THE MOST OUT OF STRAWBERRY HERBICIDES

Dominic A. Marini
Southeast Regional Fruit and Vegetable Specialist

At the present time, Dacthal* and chloroxuron, (Norex* or Tenoran*) are the most widely used materials for controlling weeds in strawberries in Massachusetts. They are useful tools, but like all tools, must be properly used to get the most out of them. They are not cure-alls; they have their limitations, but when these limitations are understood and when they are used properly, these herbicides can greatly reduce the amount of hand labor required to control weeds in strawberries.

Dacthal* is a pre-emergence weed killer. It kills only germinating weed seeds, and must come in contact with seeds as they start to germinate. In order to come in contact with germinating weed seeds, Dacthal* should be applied to soil that is moist and it must be followed by about 1/2 inch of water from rain or irrigation to move it down into the soil within 4 or 5 days after application. This is the reason Dacthal* is not effective in dry weather.

To make certain that Dacthal* comes in contact with germinating weed seeds, some growers apply it before setting plants and incorporate it shallowly into the soil with a disc harrow, or spike-tooth harrow, or finger weeder.

Chloroxuron on the other hand, is both a pre-emergence and post-emergence weed killer. It kills germinating weed seeds and weeds that are already out of the ground. Most broadleaved weeds up to 2 inches in height are controlled with post-emergence application with the exception of galinsoga, which must be treated before it is 3/4 inches tall.

Dacthal* is useful early in the season since it does not injure newly set strawberry plants. It may be applied before or immediately after setting. Chloroxuron, however, may injure newly set

*Trade name

plants and should not be used until new growth appears. It may not be used more than twice in a growing season. It has been observed that temporary injury sometimes occurs when Dacthal* and chloroxuron are applied within a few days of each other during hot weather with temperatures above 85°F. Varieties differ in their susceptibility to this type of injury.

Dacthal* is very effective for controlling crabgrass and other annual grasses, and most broadleaf weeds except for ragweed and smartweed. It is completely ineffective against galinsoga. Chloroxuron complements Dacthal* very well in that it controls most broadleaf weeds including galinsoga, but gives poor control of grasses.

To keep weeds to a minimum, some growers apply Dacthal* before setting plants and incorporate it, or apply it immediately after setting, before weeds have a chance to germinate. It remains effective for 4 to 6 weeks, then breaks down and weeds begin to appear. At this point, it is advisable to cultivate to get rid of weeds and to loosen the soil to permit runners to root easily. Then, depending on the weed population, either Dacthal* or chloroxuron may be applied immediately after cultivation; or chloroxuron may be applied when weeds emerge; or Dacthal* may be applied immediately after cultivation and be followed by chloroxuron when weeds again appear.

Dacthal* and chloroxuron may also be used in late summer or early fall to control chickweed and other fall germinating weeds. Dacthal* may be applied following the final side-dressing and cultivation in August, followed by chloroxuron in September or October. Or, chloroxuron may be used in September or early October, before the weeds are 2 inches tall (or across, in the case of chickweed).

Detailed instructions on rates of application, and other information are to be found in the "Small Fruit Weed Control Guide" available from your County Extension Service.

****

PROMOTION OF FLOWER BUD FORMATION AND FRUIT SET ON NON-BEARING DELICIOUS APPLE TREES

Duane W. Greene and William J. Lord
Department of Plant and Soil Sciences

Young Delicious apple trees are slow to come into production, so we have been conducting tests on the effectiveness of both mechanical and chemical techniques for promotion of flowering and fruiting on this variety.

---

*Trade name

Scoring is an age-old technique in which the bark is cut to the wood all the way around the trunk of a tree. This manipulation restricts terminal growth of the tree and increases flower bud initiation, and may thereby increase fruiting the following year. Limb-spreading is another technique to restrict terminal growth and encourage flowering and fruiting. Vegetative growth may also be restricted by application of some plant growth regulators, which are known to induce flowering under some conditions. During the past 3 years, we have been comparing the abilities of these techniques to restrict growth, encourage flower bud formation, and increase fruit set on young Delicious apple trees at the Horticultural Research Center in Belchertown.

Timing of a Growth Regulator Spray for Growth Suppression

A combination of Alar and ethephon applied early in the growing season can markedly suppress vegetative growth on apple trees, and has been reported to encourage flowering on young trees. To test its effectiveness on young Delicious trees in Massachusetts, a combination of Alar-85* (750 ppm) and ethephon (600 ppm) was applied at about 10-day intervals throughout the growing season. The effects of the treatments on terminal growth are shown in Table 1.

Table 1. Effect of a spray mixture containing 600 ppm ethephon and 750 ppm Alar-85* on terminal growth of spur-type Delicious trees when applied at different intervals after full bloom, 1975.

Time of application (days after full bloom)[z]	Terminal growth (cm)
Check	44ab[y]
2	31d
11	25e
22	31d
32	36c
43	41bc
53	42b
64	42b
74	41bc
85	45ab
95	44ab
107	47a
116	45ab

[z]Full bloom May 19, 1975

[y]Means in the same column followed by different letters are significantly different at the 5% level.

Greatest shoot suppression occurred when the growth regulators were applied about a week and a half after full bloom. Treatment earlier than this was less effective because regrowth of suppressed

*Trade name

shoots can occur. Later treatments were less effective because the period of most rapid shoot growth is the 4-week period following full bloom. Treatment more than 4 weeks after full bloom can be expected to have little or no effect on terminal growth since it has virtually ceased by this time. The importance of time of application lies in the fact that in experiments of this type, one usually finds that there is an inverse relationship between shoot growth and flower bud initiation: the less shoot growth, the greater the bloom the following year.

Comparative Effectiveness of Treatments for Growth Suppression

Mechanical and chemical treatments were compared for their ability to suppress growth under our conditions. All treatments did suppress growth (Table 2). However, limb spreading was less effective than the other methods, and scoring, although effective, injured the trees as evidenced by the season-long presence of red-bronze colored foliage. Consistent, sizeable growth suppression was obtained

Table 2. Effects of limb spreading, scoring, and growth regulators on terminal growth of non-spur Delicious trees.

Treatment[z]	Terminal growth (cm) 1973	1974	1975
Control	74a[y]	68a	55a
Limb spreading	53bc	51c	---
Scoring	36de	54bc	38bc
Alar, 1000 ppm (1 lb/100)	68ab	---	43b
Ethephon, 500 ppm (1-2/3 pints/100)	46cd	60ab	38bc
Ethephon, 1000 ppm (3-1/2 pints/100)	27e	48c	35cd
Ethephon, 500 ppm + Alar, 1000 ppm	49cd	47c	30de
Ethephon, 1000 ppm + Alar, 1000 ppm	34de	30d	25e

[z]Treatments applied 10-13 days after full bloom. A different set of trees was used each year.

[y]Means in the same column followed by different letters are significantly different at the 5% level.

with 1000 ppm ethephon alone, and with 500 or 1000 ppm ethephon in combination with 1000 ppm Alar-85* applied 10 to 13 days after full bloom. Trees receiving these treatments looked like spur-type Delicious. To date, the only adverse effect observed with these chemical sprays applied 10-14 days after full bloom, has been the killing of very weak spurs (less than 5% of the total number of spurs) with ethephon at 1000 ppm alone or combined with Alar-85*.

Increased Bloom and Fruit Set the Year Following Treatment

The scoring, limb spreading, ethephon and ethephon-plus-Alar-85* treatments in 1973 increased bloom in 1974 but no treatment increased fruit set (Table 3). Scoring in 1974 increased bloom but

*Trade name

not fruit set in 1975; however, ethephon, 1000 ppm plus Alar-85*, 1000 ppm did increase fruit set in 1975 (Table 4).

Table 3. Effects of limb spreading, scoring and growth regulator sprays in 1973 on bloom and fruit set on non-spur type Delicious trees in 1974.

Treatments in 1973[z]	Blossom clusters/ cm limb circ., 1974	Fruit/ cm limb circ., 1974
Check	2.0e[y]	0.16a
Limb spreading	5.6ab	0.33a
Scoring	6.5a	0.89a
Alar, 1000 ppm	2.4de	0.19a
Ethephon, 500 ppm	4.2bc	0.30a
Ethephon, 1000 ppm	5.0abc	0.77a
Ethephon, 500 ppm + Alar, 1000 ppm	3.9cd	0.24a
Ethephon, 1000 ppm + Alar, 1000 ppm	5.2abc	0.84a

[z]Scoring, limb spreading, and growth regulator treatments established May 28, 1973, 13 days after full bloom.

[y]Means in the same column followed by different letters are significantly different at the 5% level.

Table 4. Effects of limb spreading, scoring and growth regulator treatments established in 1974 on bloom and fruit set of non-spur Delicious trees in 1975.

Treatments in 1974[z]	Blossom clusters/ cm limb circ., 1975	Fruit/ cm limb circ., 1975
Check	4.63b[y]	0.50b
Limb spreading	5.13b	0.81ab
Scoring	7.16a	0.79ab
Ethephon, 500 ppm	4.77b	0.53ab
Ethephon, 1000 ppm	5.90ab	0.90ab
Ethephon, 500 ppm + Alar, 1000 ppm	4.64b	0.51b
Ethephon, 1000 ppm + Alar, 1000 ppm	5.76ab	0.97a

[z]Growth regulator treatments applied May 28, 1974, 13 days after full bloom. Scoring and limb spreading May 31, 1974.

[y]Means in the same column followed by different letters are significantly different at the 5% level.

Summary

We have shown that both mechanical and chemical techniques can suppress vegetative growth of young Delicious trees. However,

*Trade name

this response has not been consistently accompanied by greater fruit set the year following treatment. The only instance where fruit set was increased was with the most potent chemical treatment in 1974. The study was continued in 1975 and by July of 1976, more data will be available, but to date, results on fruiting have not been encouraging.

Frequently, there are blocks of young, non-bearing Delicious trees that are growing too vigorously as a result of excessive pruning and/or fertility and occasionally bearing trees will be defruited by frost. In these instances, a restriction of tree growth would be beneficial on both the older and younger trees, whether or not it is accompanied by increased bloom and/or fruit set on the young trees. To restrict growth, we suggest the following combination sprays of ethephon and Alar-85*.

Non-Spur trees: Apply ethephon at 900 ppm (3 pt/100 gal) plus Alar-85* at 1000 ppm (1 lb/100 gal) 10-14 days after full bloom.

Spur trees: Spur trees are more sensitive to growth retardant sprays than are non-spur trees. Therefore, on spur-type trees, apply ethephon at 600 ppm (2 pt/100 gal) plus Alar-85* at 1000 ppm (1 lb/100 gal) 10-14 days after full bloom.

Treatments other than limb spreading should not be applied to trees until they are large enough to bear a crop.

****

REDUCED SPRAYING FOR APPLE INSECTS AND MITES: RESULTS FROM NEW YORK

Ronald J. Prokopy
Department of Entomology

In the preceding 2 issues of Fruit Notes, I discussed results of reduced spray programs for apple insects and mites obtained in British Columbia, Michigan, and North Carolina. Here, I will discuss the results of an apple pest management pilot project carried out in commercial orchards in western New York from 1973 to 1975. Most of the project was conducted in a 5 square mile area of Wayne County, and involved 16 growers. The results, not yet published, have been compiled and summarized by 4 members of the New York State Agricultural Experiment Station at Ithaca and Geneva: Drs. J.P. Tette (Manager of Project Field Operations), E.H. Glass (Project Leader), J.L. Brann (Extension Entomologist), and P.A. Arneson (Extension Plant Pathologist).

*Trade name

The rationale leading to initiation of the project was as follows: "Although extension effort to provide New York fruit growers with the best possible advice on controlling their orchard pests has been successful, growers are receiving information and advice primarily on an area basis and often cannot interpret and adapt this to conditions on their farms. For example, pest pressures may be heavier on certain farms than on others and, presently, growers have no way of determining their specific needs for control measures. Consequently, growers predominently use insurance (preventative) type pesticide programs."

In 1973, the project was established to determine: "(1) if a pest management system could be established to integrate all the useful known and new pest management techniques, (2) if New York fruit growers could reduce their pesticide use through efficient pest management without reduction of the quality and quantity of fruit, and (3) if a core of specialists could be trained in fruit pest management to continue and expand the practices demonstrated in this system."

The approach taken in Wayne County aimed at establishing a total farm advisory program on all apple pests, beginning with pre-season grower conferences and strategy meetings, and including full (daily-weekly) in-season grower advice and consultation. The program was carried out by farm advisors and assisting field scouts trained in insect, mite, and disease management, and by research and extension personnel.

The backbone of the program was continuous monitoring of all orchards for pertinent weather data, pests, chemicals, and beneficial organisms. For example, traps baited with synthetic sex odor attractants (pheromones) were used to monitor populations of codling moth and several leafrollers (see <u>Fruit Notes 41:Jan-Feb. 1976 for further information on codling moth traps)</u>. Visual traps baited with a feeding-type odor lure were used to monitor apple maggot flies. (I will discuss apple maggot traps in the next issue of <u>Fruit Notes</u>.) Apple maggot, codling moth, and leafrollers have been controlled so well during the past decade or more that they are no longer present in most commercial orchards. But they are ever-present in nearby wild or abandoned trees. The strategy of the program was to prevent these pests from becoming established in commercial orchards. The monitoring traps were employed to detect such invasions. The data on daily or weekly pest captures in the monitoring traps also provided information on insect emergence patterns and prediction of potential pest outbreaks. Many insect pests such as plant bugs, aphids, leafrollers, curculio, scales, and fruitworms were monitored through traditional sampling methods such as emergence cages and orchard inspection. Programs encouraging the development of mite predators and other beneficial organisms were established (see <u>Fruit Notes 41:Mar-Apr. 1976 for further information on mite predators</u>). Extensive programs for precisely

predicting ascospore maturity and infection periods of apple scab and fireblight infection periods also comprised a very essential part of the pest management strategy of this project.

While the results of the project must be interpreted with caution, every indication points to the fact that the growers who followed the pest recommendations of the farm advisors realized substantial reductions in the amount and cost of pesticide usage. Specifically, the 6 growers within the project area who followed all or most of the recommendations in 1975 averaged 94% clean fruit, sprayed an average of 8 times, and incurred an average pesticide cost of $68.06 per acre. From 1973 to 1975, their insecticide, miticide, and fungicide usage decreased 10, 58, and 25%, respectively. The 4 growers within the project area who followed few or none of the recommendations in 1975 also averaged 94% clean fruit, but sprayed an average of 11 times, with an average pesticide cost of $96.29 per acre. It is very important to point out, however, that the 6 growers within the project area who followed about half of the recommendations averaged only 83% clean fruit even though they sprayed more often (9 times) and their pesticide costs were greater ($79.59 per acre) than growers who followed all or most of the recommendations. As in the old saying "half a truth is a dangerous thing", these data show that following only half the recommendations of the farm advisors in a program as complex as this pest management program was indeed counter-productive.

Do apple pest management programs of the sort carried out in New York, Michigan, North Carolina, and British Columbia, and some other states and countries have a future in Massachusetts? My answer is hopefully yes, but the road to implementation will take time. Apple production in Massachusetts is on a much smaller scale than in states like New York or Michigan. We lack the agricultural funding, equipment, and number of fruit research, extension, and farm advisor personnel that New York and Michigan have. But we intend to make a beginning, instituting the initial stages of pest management trials and demonstration plots in a few small blocks in commercial apple orchards in different parts of the state this year. We welcome your interest and cooperation.

****

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 41 (No. 4)
JULY–AUGUST, 1976

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

COMBINING CALCIUM CHLORIDE WITH PESTICIDE SPRAYS

W.J. Bramlage, W.J. Lord, A.W. Rossi, and M. Drake
Department of Plant and Soil Sciences

Growers have been using calcium chloride ($CaCl_2$) sprays on apple trees at 1X and as separate applications for the past several years to reduce the severity of cork spot and bitter pit and to increase the keepability of fruit in storage. A question unanswered is the compatibility with other pesticides when used in the regular spray program. Experience in Virginia indicates this to be a safe practice, but we had no experience in Massachusetts.

We initiated studies at the Horticultural Research Station in 1974 to accumulate information about $CaCl_2$ compatibility with other pesticides when used in a regular spray program. No foliar damage occurred on McIntosh and Delicious strains when we used 2 lbs of $CaCl_2$ per 100 gal at dilute (1X) concentration in the 5th through the 8th cover sprays in 1974 (See Fruit Notes 40(No.1):5-6, 1975). However, the results of another study showed that this 2 lb-rate of $CaCl_2$ produced only a slight increase in fruit calcium (Ca). In 1975, we decided to increase the $CaCl_2$ rate and to determine whether it could be concentrated. Thus, $CaCl_2$ was applied as 4 lbs per 100 gal of water (1X) and as 24 lbs per 100 gal (6X concentrate) starting with the 2nd cover spray in the schedule shown in Table 1.

Some burn on the tip and edges of McIntosh leaves was observed after the 3rd cover spray, regardless of concentration. This damage was considered excessive on McIntosh strains when the $CaCl_2$ was applied at 6X concentrate. The injury from sprays applied at 1X with a hydraulic sprayer was not considered excessive and did not increase with the 4 additional sprays of the same concentration. Furthermore, in a separate experiment in which the 1X spray of $CaCl_2$ was applied with a "speed-sprayer" little or no injury occurred on McIntosh leaves. However, it must be noted that 6 inches of rain fell between the 4th and 5th cover spray, 2.5 inches fell between the 5th and 6th cover spray, and 3.0 inches fell between the 6th and 7th cover spray. Without this rainfall, the injury might have been more severe. Clearly, at 4 lbs $CaCl_2$ per 100 gal there is potential for foliar injury to McIntosh, and this potential is much greater when the spray is applied as a concentrate.

Was the $CaCl_2$ spray beneficial? In a separate experiment, we found that 7 sprays of $CaCl_2$ (1X) at 4 lbs per 100 gal increased the Ca level in fruit 50%. Assessment of the value of this increase in improving storage life of the fruit is still incomplete, but to date we have found that the 50% increase in fruit Ca virtually eliminated bitterpit and internal breakdown after regular storage to January. Thus, it appears that repeated application of 4 lbs per 100 gal of $CaCl_2$ has the potential for substantially improving stor-

age life, but we need more experience to determine if this rate can be safely applied to McIntosh trees in Massachusetts.

Spray Record at H.R.C., Belchertown, starting with 2nd cover, 1975.

Application	Date	Materials used/100 gal spraying dilute[z]	Weather[y] and other comments
2nd cover	6/6	Thiram,65%WP,1-1/2 lb Imidan*,50%WP,1-1/2 lb $CaCl_2$,4 lbs[x]	Cloudy
3rd cover	6/20	Captan,50%WP,1 lb Imidan*,50%WP,1 lb Endosulfan,50%WP,1 lb $CaCl_2$,4 lbs	Clear, windy 1.8 inches of rain between 2nd and 3rd cover.
4th cover	7/7	Captan,50%WP,1 lb Imidan*,50%WP,1 lb Propargite,30%WP,1 lb $CaCl_2$,4 lbs	Warm and clear 0.2 inches of rain between 3rd and 4th cover.
5th cover	7/18	Same as 4th cover	Warm, cloudy 6.0 inches of rain between 4th and 5th cover
6th cover	7/31	Captan,80%WP,5/8 lb Imidan*,50%WP,1 lb $CaCl_2$,4 lbs	Warm, clear 2.5 inches of rain between 5th and 6th cover
7th cover	8/16	Captan,80%WP,5/8 lb Imidan*,50%WP,1 lb Kelthane*,18.5%EC,1 pt $CaCl_2$,4 lbs	Warm, clear 3.0 inches of rain between 6th and 7th cover

[z]When spraying 6X, approximately 5 times more used/100 gals. With $CaCl_2$, 24 lbs/100 gals.

[y]All sprays applied at 6 to 8 A.M.

[x]$CaCl_2$: 77-80% Flake

What should the apple growers do in 1976? We suggest that you spray your trees with 3 lbs $CaCl_2$ per 100 gal as separate applications and at 1X, beginning about the 1st cover and repeated at 2 to 3 week intervals, totalling 5 to 6 applications. Those who apply pesticides at 1X may want to add the $CaCl_2$ to one tankful in each cover spray as a trial; we have seen no evidence of incompatibility but with the many possible combinations, caution is advised. If foliar damage appears and is considered excessive, reduce the $CaCl_2$ concentration to 2 lbs per 100 gal in subsequent sprays.

*Trade name

We cannot recommend application of $CaCl_2$ in a concentrate spray, whether alone or with pesticides. Research by Dr. George Greene at Pennsylvania State University, indicates that it can be applied in concentrate on York Imperial trees. However, we do not know what concentration of $CaCl_2$ can be safely applied to McIntosh trees in Massachusetts. The grower who applies $CaCl_2$ in concentrate sprays does so with considerable risk of failure or injury to the foliage.

****

POMOLOGICAL PARAGRAPH

"Grow 'em" like tomatoes. When questioning researchers in the Netherlands as to whether the trend toward small apple trees and high density plantings has gone too far, one facetiously remarked, "We will end up growing apples like tomatoes." Apples will always be borne on branches above the ground (how much above is anyone's guess), but the Dutch are experimenting with a planting system which involves planting the tree underground. The "Dutch Multi-Shoot System" is being tried in an attempt to overcome a major problem with the meadow orchards: the high establishment cost because of tree numbers ranging from 12,000 to 28,000 trees per acre. The "Dutch Multi-Shoot System" involves laying 1-year-old unfeathered (unbranched) trees in a shallow trench (about 6 inches deep), end to end, and covering the stem with soil. Trees planted this way will produce roots at the node and the buds will develop stems. Thus, several trees on their own roots can be eventually established from a single young tree by severing the stems from the parent tree. By using 39 inch parent trees and 39 inch alleys, tree numbers can be reduced to about 4000 trees per acre in comparison to 12,000 to 28,000 trees for the meadow system. The Dutch favor cropping these trees 2 to 4 years before mowing the tree near ground level instead of after the first harvest as is done with the meadow system. Research with this novel idea is still in its initial stages, and like many approaches to "super" intensive plantings and mechanical harvesting, it may not prove feasible. However, techniques and novel ideas like this may eventually revolutionize tree fruit growing.

****

PICK-YOUR-OWN STRAWBERRIES

Dominic A. Marini
Southeast Regional Fruit and Vegetable Specialist

Pick-your-own is not new. Some growers adopted this method of marketing strawberries over 20 years ago because of the difficulty of obtaining harvest labor. It grew gradually until a few

years ago, when the effects of inflation felt both on the farm and in the supermarkets suddenly stimulated new awareness of its advantages. Farmers seeking alternative crops to increase income, and consumers searching for ways of stretching their food dollars, have found it to be of mutual advantage and pick-your-own is booming at present.

The greatest advantage of pick-your-own for the grower is elimination of the problem of finding adequate harvest labor. Not all labor is eliminated, however, since it is necessary to have supervisory help in the field to direct parking, explain the rules, show people where and how to pick, and to tally and collect the money. The greatest problem is providing enough fruit to avoid disappointing customers, many of whom travel long distances to pick berries. In addition to the obvious advantage to the customer of saving some money, there are other advantages including quality and freshness and for many urban dwellers, an outing in the country. Location is not a problem. A recent survey indicated that 45% of pick-your-own customers traveled 10 to 25 miles and that 20% traveled 25 to 50 miles.

For the grower, there are other savings in addition to harvest labor. The costs of baskets and shipping trays or crates are eliminated, along with shipping and selling costs. (Some growers even make a profit on baskets sold to customers who come to pick without containers.) In addition, the fields are picked clean. Pick-your-own customers will pick small, deformed, cull berries that hired pickers would not bother with and that most growers would not offer for sale.

Pick-your-own is not for every grower. Some would not allow the public in to pick their berries under any circumstances. Obviously, it is not for these growers. And, you have to like people and enjoy dealing with the public to be successful.

The first requirement in a pick-your-own operation is parking facilities as close to the fields as possible. On busy days, a person to direct traffic helps to get the customers in and out quickly. Separate entrance and exit roads help to keep traffic flowing smoothly. Some growers provide transportation to and from fields located a distance from the parking area.

Most growers do not allow small children into the fields and some provide playgrounds to keep children occupied. Sheep, goats, ducks and other animals are also desirable to attract the attention of children.

Wider aisles between beds for walking and picking are desirable for pick-your-own customers, who are not accustomed to the narrow aisles with rows spaced 3-1/2 feet apart. A spacing of 4-1/2 or 5 feet would allow more room. Easy picking varieties, such as

Sunrise and Raritan, with tender stems that break easily are desirable to facilitate picking and reduce fruit bruising. Short rows are more convenient for assigning rows to pickers.

Supervision in the field is a "must." Rules should be posted where customers can read them before entering the field. Supervisors must be present in the field at all times to show customers how to pick, to assign them rows to pick, and to make certain that all rules are observed. It is best to tally the berries and collect the money as the customers leave the field and before they return to their cars.

Some growers harvest the fields once or twice before allowing the public in; others harvest first-year beds themselves and allow public picking on second and third-year beds.

Some growers allow customers to pick into any kind of container and charge by weight; others insist that they pick into quart boxes to reduce bruising and charge either by weight or by the box. Some growers allow customers to heap the boxes as high as they can; others charge extra for boxes heaped higher than specified in their rules.

To avoid the problem of "how full is full", growers are increasingly charging by weight. Most growers vary prices according to the picking, charging the top price where berries are large and plentiful and a lower price where berries are smaller and less abundant. In 1975, the price range in southeastern Massachusetts was 55¢ to 65¢ per quart and 40¢ per pound. A quart weighs about 1-1/2 pounds.

Growers with pick-your-own operations do very little advertising. Most advertise once or twice to let customers know when the berries are ready and after that, they don't have enough berries, so advertising isn't necessary. Some have a mailing list of customers and send cards to them when the berries are ready.

Public picking is an idea whose time has come. Cost-conscious consumers and those looking for freshness and quality have accepted it. And growers having difficulty finding harvest labor, and seeking ways to increase gross income, are finding that pick-your-own strawberries is one way of doing it.

****

THE PEACH TREE REPLANT PROBLEM

C.J. Gilgut, Extension Plant Pathologist
Department of Plant Pathology

Peach growers commonly find that a new peach tree, planted where a peach tree has died and been removed, grows poorly and often

dies. And, in an orchard site from which old trees have been removed recently, new trees grow poorly and do not live as long as those planted on new land.

This problem has been known for many years and is world wide. It is referred to as "the peach replant problem," "the short life of peach replants," "peach decline, "soil sickness" and even "winter injury."

The symptoms above ground are the same as caused by any condition that interferes with good root development and function. The plant grows poorly and has a sickly appearance. Later, there may be dieback of twigs and branches and the plant may even die. Below ground, on declining plants, the feeder root system is poorly developed and inadequate. Some roots have large brown or dead areas and many of the feeder roots are shriveled and dead.

Investigators name different causes for the trouble - soil-borne fungi such as Pythium spp. or Phytophthora spp., Clitocybe root rot, bacterial canker, nematodes, winter injury, drought, soil too wet, high soil temperature, over-fertilizing, starved plants, etc. Each of these causes has been found to be responsible at some time or other in different orchards. Some investigators agree on several causes, others do not. Most likely several conditions, either occurring at the same time or one after the other, are responsible. For example, it is quite common in spring for soils to be wet and cold - a condition that does not favor feeder root development of peach trees. But it does favor development and root invasion by soil fungi such as Pythium and Phytophthora. As the soil dries and becomes warmer, it is less favorable for these two fungi but more favorable for development and invasion of roots by nematodes which further weaken the root system. As the season progresses and rains are less frequent, the soil becomes even drier, and often drought conditions exist, at least for a while. At the same time the hot weather evaporates large quantities of water from the leaves of the trees. A poor or weakened feeder root system in a soil that does not have enough water and even in a wet soil cannot keep up with the water demand of the tree and the stress shows up as weak and poor growth of the tree above ground. Weakened trees are susceptible to bacterial canker, twig and branch dieback caused by several fungi such as Cytospcra and Valsa, and winter injury, and the whole business ends up as "decline" and dead trees.

Rather than review in detail the extensive research that has been done over the years on the replant problem, it may be helpful to give some of the conclusions of some of the more recent investigations.

The following is from "Peach Decline in Georgia," Georgia Agricultural Experiment Station Bulletin 77, June, 1970. It reports investigations from 1929 - about 40 years.

1. "We have concluded that Pythium spp. cause reduced vigor by killing the feeder roots of peach trees, making them more responsive to stress conditions such as fruit set and prolonged drought and cold."

2. "Winter and spring rains produce periodically flooded and saturated conditions in the field. These conditions along with moderately cold temperatures favor build-up, liberation, dispersal, and infection by Pythium. Moreover, the flooded and saturated soils are slower to warm, thereby further retarding root growth of host plants. These factors acting and interacting together severely restrict root growth at a time when it is at a premium due to demands of bud-break and initiation of flowers and leaf growth."

3. "Factors active in reduction of feeder root systems of peach trees in Georgia include Pythium species, nematodes, and cultural practices."

4. "From our data, we concluded that although all three are important, the first step in any control program is the reduction of root injury from discing. Peach trees are shallow rooted and the majority of feeder roots are in the top 8 inches of soil. Discs frequently penetrate 6 to 8 inches destroying most of the surface feeder roots."

5. "Pythium spp. and nematodes even when present in moderate numbers reduce vigor of peach trees enough to result in greatly increased mortality. They usually operate in an orchard simultaneously. If the Pythium population is low to moderate, elimination of discing, and a reduction of the nematode population will reduce disease severity."

6. "Fumigation will reduce the Pythium and nematode populations so that trees can become established before re-infection."

7. "Trees in plots which were solidly tarped after injection of 170 or 200 pounds (per acre) Trizone were larger, more vigorous, and more uniform than those in plots strip treated with 170 pounds of Trizone . Pythium populations were effectively reduced in the strip treatment but build-up was more rapid than in the broadcast treatment."

8. In the Section, "Control of Peach Tree Decline in Established Orchards,"

   a. -----"the single most significant factor in the reduction of tree loss is the elimination of discing in the orchards." (Sinbar was used for weed control).

b. "The next most beneficial practice appears to be the use of Fumazone where sub-soiling is not done." (Fumazone 70% EC at 5 gal/A was injected 6 inches deep in 5 foot strips on each side of the trees after planting.)

c. "It appears that post plant nematicides improve both tree survival and yield but no post plant treatment with nematicides is as effective or as desirable as preplant treatments."

d. "It is also apparent that sub-soiling after planting is beneficial, particularly where herbicides are used. It improves sub-surface drainage and breaks up hard pan layers to allow better root colonization." (The sub-soiling consisted of 3 sub-soil furrows - one down the center between rows and one 5 feet on each side of center in November.)

9. In Research Bulletin 30, May 1968, Georgia Agricultural Experiment Station, "The effect of sub-soiling on growth and yield of peach trees" we have,

a. Preplant sub-soiling in March consisted of one furrow in row where plants were to be set and one 20 inches out on each side, with furrows 22 inches deep, in sub-soil dry enough to break up well.

b. During 3 years of measurements, where there was no sub-soiling, trees grew only a little more than half as much as trees where it was sub-soiled.

c. Over 8 crops, trees in preplant sub-soil yielded nearly twice as much as where not sub-soiled.

d. After 13 years, 71% trees in preplant sub-soil were alive and only 47% in plots not sub-soiled.

e. A second sub-soiling -- a furrow 4 feet from the trees on each side, a year after the trees were planted, showed no improvement in growth over the single preplant sub-soiling.

f. The experiment also showed "that once stunted the trees never attained the growth and size of the trees which were able to establish a good root system and grow off rapidly the first growing season."

10. "A deficiency of any element (N,P, or K) necessary for healthy growth may cause increased susceptibility to cold damage."

11. In California - "soil fumigation and fertilization affected tree survival." With trees replanted, where trees killed by bacterial canker were removed, "During the first three years after planting, no trees were killed by cankers where soil was fumigated either with DD or Picfume prior to planting. Tree mortality in non-fumigated plots ranged from 25% in complete fertilizer plots to 85.9% in low nitrogen plots. Growth of trees was significantly greater in fumigated plots than in plots not fumigated."

12. In South Carolina - "October pruning followed by inoculation with bacterial canker caused winter injury in addition to typical bacterial canker symptoms. Trees pruned in February and inoculated with the canker organism suffered little damage from either winter injury or bacterial canker. It is suggested that trees be pruned only after they are completely dormant."

Suggestions for Planting and Replanting Peach Trees

From the many years of research on replant survival of peach trees, some practices are indicated which should improve survival of trees planted in a new location or in a location where trees have died and have been removed. A half-hearted effort will not give satisfactory results.

The suggestions listed below are the same as those of the Georgia Agricultural Experiment Station Peach Decline Committee.

New Orchards

1. Plant where peaches have not been planted before, if at all possible. This gets away from root-attacking soil fungi, nematodes, and other causes of trouble which have built up over the years in the old orchard site.

2. Plow and prepare soil.

3. Follow suggestions 2 through 11 in section on Planting an Old Orchard Site.

Planting an Old Orchard Site

1. Remove old trees, plow soil, and remove old roots and other debris.

2. Subsoil before planting. It improves subsurface drainage and breaks up levels of hardpan layers to allow better root development. In the experiments, three subsoil furrows were made about 22 inches deep - one in the rows where the trees were to be planted and one 2 to 3 feet on each side. Furrows were in subsoil dry enough to break up well.

3. Fumigate the soil to kill nematodes and reduce the amount of soil-inhabiting fungi. It gives the newly planted trees a chance to get established and start growing before populations of these soil-inhabiting organisms build up again.

   Fumigate in September or October and it will be safe to plant next spring. Spring fumigation takes at least 2 weeks and considerably longer, if the weather is cold and wet, for the fumigant to leave the soil so it is safe to plant.

   Satisfactory soil fumigants are dichloropropene type - DD or Vidden D at 40 gallons, or Telone at 32 gallons per acre; EDB (ethylene dibromide), Dowfume W-85 , or Soilfume 85 at 9 to 10 gallons per acre; DBCP (1-2 dibromo-3-chloro-propene) - Nemagon EC2 or Fumazone 70E at 5-8 gallons per acre; also Trizone at 170 pounds per acre. Read the label and follow directions and precautions.

   Applications should be 8 to 10 inches deep in rows 12 inches apart and sealed in by drag or roller. There will be a better seal of fumigant if the top 4 or 5 inches of soil is worked into a fine seedbed condition before fumigation.

   Unless a grower wants to go to the expense of building and calibrating a tractor-drawn chisel or plow sole application rig, he can have the job done by a custom applicator. They have properly made and calibrated rigs and know how to use them.

4. Lime and fertilize according to soil test.

5. Plant trees from nurseries where soil was fumigated with methyl bromide.

6. Best rootstock appears to be Lovell - better than Elberta seedlings.

7. Follow a disease and insect control program from the time of setting.

8. Prune in spring - better than pruning in fall or winter.

9. Avoid discing - follow herbicide program.

10. Provide water the first year if needed, so plants will get a good start, and also during droughts in later years.

11. Extra nitrogen in August seems to improve survival in Georgia. (In Massachusetts, follow Massachusetts fertilizer recommendations.)

Replanting in a Peach Orchard Where Trees Have Died

The same procedure as replanting in an old orchard site apply but, because a location where a tree has been removed is small and the locations are scattered through the orchard, a rototiller can be used to prepare a planting site. The fumigant can be applied with a hand applicator and the fumigated area covered with a polyethylene tarp.

****

EARLY ETHEPHON SPRAYS FOR FLOWER BUD INITIATION AND RIPENING OF APPLES

D.W. Greene, W.J. Lord, and W.J. Bramlage
Department of Plant and Soil Sciences

Ethephon sprays to enhance red color development on apples is now an established practice. In our studies with ethephon, we have also been interested in its potential for initiation of flower buds on bearing trees. Our early studies showed that ethephon at rates of 500 to 1000 ppm (1-2/3 to 3-1/3 pt/100 gal) thinned Cortland and Mutsu apples when applied 26 to 44 days after full bloom. No fruit abscission of Mutsu occurred at 250 ppm (5/6 pt/100 gal) when ethephon was applied 35 to 44 days after full bloom but flower bud initiation was not increased. In an experiment in 1973 with Early McIntosh, we found that a combination spray of Alar-85* and ethephon applied after the completion of June drop caused no fruit abscission, and that increased flower bud initiation was recorded the following spring. In 1974, we expanded our studies on flower bud initiation with ethephon on bearing trees, and included Cortland, McIntosh, Red Delicious, and Early McIntosh. Our findings are summarized below.

Early McIntosh. We failed to verify our 1973 results. Post-June drop applications of ethephon (July 8) at 250 ppm and 500 ppm stimulated fruit ripening within a week after application and the entire crop dropped prior to normal harvest. Furthermore, unlike 1973, the ethephon sprays in 1974 failed to enhance repeat bloom in 1975.

Cortland. The response of this cultivar to ethephon was strikingly different from that of Early McIntosh. Concentrations up to 1000 ppm, applied at the same timing, caused no fruit abscission. Red color enhancement was slight, and only at 1000 ppm did ethephon reduce flesh firmness. However, respiration studies showed that 1000 ppm ethephon clearly stimulated earlier ripening, while lower concentrations produced a small advancement of ripening and Alar-85*

*Trade name

reduced the ethephon effect. Ethephon alone at 500 ppm or 1000 ppm or ethephon at 500 ppm plus Alar-85* at 1000 ppm suppressed fruit size. None of the treatments increased repeat bloom in 1975.

McIntosh. Post-bloom sprays of ethephon were applied on July 22 and August 8 on this cultivar. Ethephon at 1000 ppm applied on July 22 eliminated the crop and 500 ppm thinned excessively, whereas trees receiving 250 ppm ethephon on July 22 lost only 16% of their crop and averaged 68% red color on fruit by August 28. Ethephon applied at 75, 125, or 250 ppm (1/4, 5/12 and 5/6 pt/100 gal) on August 7, enhanced red color development and only the highest concentration caused excessive drop by August 28. All concentrations of ethephon on both dates increased soluble solids (sugar content) and decreased flesh firmness. This advancement in fruit maturity was confirmed by respiration data. The ethephon sprays as on Early McIntosh and Cortland failed to enhance repeat bloom in 1975.

Red Delicious. Ripening of this cultivar also was stimulated by ethephon. Both 500 and 1000 ppm caused fruit drop and all concentrations advanced watercore development and suppressed fruit size. Alar-85* was capable of reducing the ripening effects but caused further fruit size suppression.

A loss of flesh firmness which usually accompanies ripening did not occur with the ethephon-treated fruit, probably due to the presence of water core. The watercore in the fruit tissue may have increased the resistance to the plunger of the pressure tester.

The ethephon and ethephon plus Alar-85* sprays, with the exception of ethephon at 250 ppm, increased repeat bloom in 1975 but no treatment increased fruit set.

Conclusions

Increased flower bud initiation is not a consistent response of apple cultivars to post-June drop applications of ethephon. Summer applications of ethephon can advance harvest date but the question is --- can it be done consistently without excessive fruit drop? Our 1975-1976 studies may help to answer this question, but even if feasible, the value of the advancement is questionable. We generally are not concerned about advancing the maturity of Cortland and Delicious since the harvest of these cultivars is usually delayed until McIntosh harvest is nearly complete, and therefore, they are often overmature. The use of ethephon might aggravate this problem. Fruit size on McIntosh trees harvested the 3rd or 4th week of August might be excessively small except on young trees or those with a light crop. Thus, it appears that mid-July or early-August applications of ethephon have little value when one considers the risk of excessive fruit drop, loss of fruit size or advanced maturity. Present recommendations for ethephon's use which permits the harvest of McIntosh in the first week of September appears to be a safer practice.

****

*Trade name

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State Laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business
Penalty for Private Use, $300.

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

BULK THIRD CLASS MAIL PERMIT

U.S.MAIL

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 41 (No. 5)
SEPTEMBER–OCTOBER 1976

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

BAITED YELLOW RECTANGLES FOR TRAPPING APPLE MAGGOT FLIES

Ronald J. Prokopy
Department of Entomology

There are about a dozen major insect-type pests of apples in Massachusetts. Some of these, such as mites, rosy and green aphids, leafhoppers, and scale insects attack the vegetative parts of the tree and can be tolerated in small or moderate numbers without economic injury. In unsprayed orchards, predators and parasites aid in suppressing these vegetative pests at population levels which are not injurious. Most of our common orchard sprays are highly toxic to predators and parasites, and hence we must spray additional materials to prevent these vegetative pests from reaching economically injurious levels.

There are other major pests of apples, such as plum curculio, codling moth, red-banded leafroller, sawfly, and apple maggot whose larvae (worms) feed directly on or in developing or mature fruit. Even small numbers of adults of any one of these fruit pests in a commercial orchard can cause economic injury. Numerous studies and observations have shown that the apple maggot is one of the most damaging of these pests in the northeastern states, including Massachusetts. In unsprayed trees, usually 95-100% of the fruit is infested by apple maggot larvae.

In commercial orchards, the last 3-5 insecticide cover sprays of the season are directed principally against the apple maggot. In nearly all cases, I expect that most or all of these maggot cover sprays are applied as a preventative, irrespective of whether or not flies are actually present in the orchard and constitute an economic threat. Development and use of effective traps to monitor maggot fly populations would tell a grower when, if at all, maggot flies first appear in his orchard, and when they have died out for the season. With this knowledge, the first maggot spray could be delayed until first fly capture on the traps, and the last one or two maggot sprays eliminated if no further maggot flies were captured. In this day of rapidly increasing pesticide costs and restrictions on pesticide usage, any pesticide reduction without sacrifice of fruit yield or quality will make for greater profit and less environmental damage.

I've been studying apple maggot fly behavior for several years, and in this article will relate how certain of these studies have aided in the development of effective apple maggot traps.

Apple maggot flies emerge from overwintering puparia (cocoons) in the soil. They spend the first week or two of their lives feeding on insect honeydew (the sugary secretion of aphids and similar

insects). This honeydew accumulates principally on the surface of foliage, and the flies' feeding activities may carry them to all sorts of foliage, not just apple or their native host, hawthorne.

How do the flies locate foliage, especially foliage with honeydew on it? Studies conducted in Wisconsin in 1972 by Drs. Guy Bush and Stewart Berlocher (University of Texas), and Dr. Volker Moericke (University of Bonn, West Germany), and myself showed that the flies locate foliage principally, perhaps even exclusively, by its physical characteristics. The size and shape of a foliated tree had some influence on attraction, but the most important factor was foliage color.

The color of foliage in summer (when flies are active) is green. We found that apple maggot flies (as well as cherry flies in Switzerland and olive flies in Greece) were more attracted to wooden rectangles painted green than to ones painted red, blue, white, gray, or black. What was surprising, however, is that the flies were much more attracted to yellow rectangles than to green ones, especially to the very intensely reflective color of daylight fluorescent yellow.

Why should the flies be much more attracted to bright yellow color than to green? With the aid of a spectrophotometer (an instrument which measures wavelengths of light reflectance), we found that green leaves reflect most light from about 520-580 nanometers (nm) in the visible spectrum. (Violet reflects most light at 360-430 nm, blue at 430-500 nm, green and yellow at 500-590, orange at 590-630, and red at 630-760 nm). It turns out that daylight fluorescent yellow paint, just as green leaves, reflects its maximum energy from 520-580 nm. But the amount of energy relected from 520-580 nm by the yellow paint is much greater than by green leaves. We believe that the reason that flies are more attracted to yellow than green is that they perceive yellow as if it were super-bright or super-intense foliage.

What practical use can be made of this information? We painted daylight fluorescent yellow paint (Saturn Yellow*, manufactured by Day-Glo Corp., Cleveland, Ohio) onto small (about 6" x 8") wooden or cardboard rectangles, coated the rectangles with a clear sticky odorless substance (Bird Tanglefoot*, manufactured by the Tanglefoot Co., Grand Rapids, Michigan) to capture arriving flies, and hung these rectangles in fruit trees in the U.S. and Europe. They proved to be very useful in attracting and capturing apple maggot, cherry maggot, and olive flies and are now being widely used to monitor the activities of these pests in orchards. In fact, when these traps were employed by colleagues in Switzerland (Dr. Ernst Boller and associates) at the rate of 2.5 per cherry tree in one orchard and 1.7 per tree in another, they captured enough female and male cherry flies to provide a high degree of direct control

---

*Trade name

(larval infestation in the fruit was reduced by 90%). For direct fly control, this method of capturing the flies with sticky yellow traps is laborious and doubtless uneconomical on a large scale. But it does illustrate the effectiveness of the traps.

Studies originated by Dr. Ralph Dean in the Hudson Valley in the 1930's and Dr. A.C. Hodson in Minnesota in the 1940's showed that apple maggot flies are attracted to the odor of decomposing protein and the odor of ammonia. The real reason for this attraction isn't known for certain. But it is known that the insect honeydew on which the flies feed does contain amino acids (the building blocks of protein). It seems quite likely that as honeydew ages, it decomposes slightly, and in the process gives off ammonia (which is a product of protein putrefaction). Hence, the flies may be cueing in on ammonia as a guide to locating honeydew.

Ammonia-type substances and protein hydrolysates have now been added to the sticky-coated daylight fluorescent yellow rectangles to combine in one trap the essential visual and olfactory stimuli eliciting the food-finding behavior of the flies. Currently, Zoecon Corporation (c/o Dr. W.H. Palmer, 346 South Avenue, Williamson, N.Y. 14589) is marketing this type of trap. It is a Saturn Yellow* 9" x 10" cardboard rectangle. One surface of the rectangle is coated with Bird Tanglefoot*, with protein hydrolysate and ammonium acetate mixed into the Tanglefoot. For transport and handling the card is folded in half, with the Tanglefoot area inside. The trap is easily assembled for use by folding back the cardboard to expose the Tanglefoot, and attaching a wire for hanging it in an apple tree.

Every grower knows from past experience which of his blocks are in greatest danger from maggot attack. Employment of 1-2 traps per acre in maggot hot-spots would provide instant information on the status of the maggot fly population. This will aid in better timing of maggot sprays, and avoidence of unnecessary applications when no maggots are present.

In the next two issues of Fruit Notes, I will discuss other aspects of apple maggot fly behavior which have practical import.

****

COLLECTING SOIL SAMPLES FOR NEMATODE IDENTIFICATION

R.A. Rohde
Department of Plant Pathology

The plant-parasitic nematodes that attack fruit trees live in the soil and feed on the roots. They are too small to be seen unless removed from the soil. Nematode populations vary greatly both

horizontally and vertically in roughly circular patches and sampling is generally a compromise hoping to truly estimate the population without collecting an unreasonable amount of soil.

When to collect: Any time of year, although populations are largest during late summer.

Where to collect: If a field is being sampled prior to treatment, a systematic sampling should be made of future planting sites. Established trees should be sampled at the drip line.

What to collect: An ideal sample would consist of 20 cores, 1 inch diameter by 12 inches long, taken in a zig-zag pattern from an area 10 x 100 feet. This much soil should fit into 2 1-quart plastic bags. Include any roots that may be present. For a large orchard, additional 1000 sq. ft. strips should be sampled separately.

Send: Samples sealed in a plastic bag or container. Dry samples such as those collected for chemical analysis are useless. Ordinary temperatures won't hurt but don't leave samples in a hot car trunk. Massachusetts fruit growers can bring or mail the samples to: R.A. Rohde, Department of Plant Pathology, Fernald Hall, Univ. of Massachusetts, Amherst, Mass. 01002.

****

POSTHARVEST DIPS OF APPLES IN CALCIUM CHLORIDE SOLUTION

Heather A. Betts and William J. Bramlage
Department of Plant and Soil Sciences

In recent years, there has been a growing recognition worldwide that calcium (Ca) can play an important role in protecting apples from different physiological disorders -- on the tree, but especially off the tree during and following storage. We have been finding during the past few years that Massachusetts apples, too, are often Ca-deficient and that this is contributing to storage problems. Consequently, we have been investigating ways of correcting this problem.

One approach to the problem is the use of postharvest dips in Ca-containing solutions. A number of researchers have tested dips, and have generally found them to be relatively effective. However, there are many factors that might influence the successful use of Ca dips, and these effects are very poorly understood. During the past year, we conducted an intensive study of factors affecting absorption of Ca from a postharvest dip solution, results of which we report here.

We have dipped several varieties of apples in various concentrations of $CaCl_2$ from 0.5% (4 lbs/100 gal) to 4% (32 lbs/100 gal). We found that little Ca was absorbed during the actual dip and that uptake was mainly during storage from residues left on the apple. Thus, the length of time apples actually spent in the dip was not important, whether it was as short as a few seconds or as long as 60 minutes. Also, the solution temperature, whether cold or hot, did not in itself affect Ca uptake. However, we observed that putting warm apples into a cold solution may increase the uptake and will of course have the added benefit of helping to cool the fruit. Apparently, the cooling apple forms a partial vacuum that draws some Ca solution into the fruit from the dip solution.

The factor most influencing the uptake of Ca is the concentration of $CaCl_2$ in the solution. The optimum $CaCl_2$ concentration for the dip is not yet clear. Low concentration (0.5 and 1.0%) of $CaCl_2$ were insufficient to substantially increase the Ca level of apples. The effects of a 2% solution were variable; 2% significantly increased the Ca in 'McIntosh' stored for 3 months, but did not significantly increase 'Cortland' or 'Baldwin' flesh Ca. This does not mean that at 1% and 2% concentrations the Ca is not penetrating the fruit; tests with radioactive Ca demonstrated that a 2% solution did penetrate into the flesh. However, individual fruits vary greatly in their native Ca concentration as well as in their ability to absorb Ca, so that the effect of the 2% $CaCl_2$ was not great enough to significantly overcome these variations within our relatively small sample sizes. Whether or not 2% $CaCl_2$ is a high enough concentration to substantially raise the Ca level in the fruit during storage probably depends on the conditions of the fruit and the storage. Furthermore, the most suitable $CaCl_2$ concentration probably varies with the variety being treated and the growing conditions. We found that 4% $CaCl_2$ significantly increased flesh Ca in all varieties tested; this very concentrated solution (32 lbs of $CaCl_2$/100 gal) can probably be counted upon to raise the Ca level in apples under most conditions that might be encountered, but it is also probably more concentrated that necessary under many conditions and may lead to problems, as will be mentioned later.

How does Ca enter the apple, since absorption is almost entirely from residue? We tested this question using radioactive Ca "tracers" and found that absorption appears to be almost exclusively through natural openings in the fruit, but at a very slow rate. Therefore, the more openings available (open lenticels, open calyx, punctures, etc.) the more readily Ca will penetrate. However, different varieties and individual fruits within a variety varied greatly in openness. Submerging cold apples in warm water and observing air bubble formation may be a quick test to determine these fruit openings and thus get an indication of how readily they will respond to postharvest dips; if many bubbles appear quickly, perhaps reduced $CaCl_2$ concentrations may be used.

Various additives have been reported to influence Ca absorption from a $CaCl_2$ dip, E.g., certain "thickeners" have been reported to greatly increase absorption, and wetting agents to reduce it. Further, commercial adoption of the practice would likely incorporate $CaCl_2$ into a solution containing a scald inhibitor and fungicide. The presence of thickeners, a strong wetting agent, a fungicide, a scald inhibitor, and combinations of these materials in a 2% $CaCl_2$ dip neither aided nor hindered Ca uptake by 'McIntosh' nor produced any adverse effects on the apples. Thus, a $CaCl_2$ dip can be successfully combined with a wide range of other materials. It is noteworthy that we have had no success in trying to increase Ca absorption through use of "thickeners," and cannot recommend their use.

It must be recognized that uptake of Ca from residues is slow. Relative humidity (R.H.) of the storage atmosphere is a factor that can influence this uptake. Whether this influence is good or bad, again would seem to depend on the specific conditions you are working with. It appears that a high R.H. (95-98%) has a positive influence if it keeps the $CaCl_2$ residue from drying out, so that the apples can continue to absorb Ca for several months. On the other hand, a low R.H. (85-90%) may concentrate a weak solution (that is make a 1% $CaCl_2$ solution act like a 4% $CaCl_2$ solution) and increase the rate of Ca absorption, but if the low R.H. causes the residue to completely dry up, the absorption will cease. Thus, at a low storage R.H., rapid penetration of Ca may occur, but only for a short period of time. Since apples are normally stored for many months, high R.H. is probably desirable, to maintain uptake over a long period of time and thus obtain maximum benefit from dips. If you maintain a high storage R.H., you can probably obtain considerable benefit from moderate $CaCl_2$ concentrations in the dip solutions and avoid the necessity for the very high (3% or 4%) $CaCl_2$ concentrations.

Will postharvest $CaCl_2$ dips improve the storageability of Massachusetts apples? We conducted a small scale pilot study to measure potential benefits to fruits from the $CaCl_2$ dip treatments. A 2% or 4% $CaCl_2$ dip significantly increased the flesh Ca of 'McIntosh' and decreased their internal breakdown from 16% in the controls to 2-3% in treated samples. Also, the fruit dipped in 4% $CaCl_2$ were significantly firmer than the controls after 3 months storage. In 'Cortland', breakdown was seemingly reduced from 17% in the controls to 6% in samples dipped in 4% $CaCl_2$. These were encouraging results, and there is another way to look at the results,too. In Massachusetts, a flesh Ca concentration of about 225 ppm appears to be optimum for quality retention during long-term storage of apples. Fruits frequently possess Ca levels substantially lower than this at harvest, and therefore, have a high potential for deterioration. Ca concentrations in 'McIntosh' and 'Cortland' were increased more than 100 ppm by a 4% $CaCl_2$ dip, and 50 ppm by a 2% dip, and in 'Baldwin' more than 60 ppm and about 30 ppm by 4% and 2% dips, respectively. Dips therefore made the fruits considerably more suitable for long-term storage. We believe that

$CaCl_2$ dips have the potential for marked reductions of storage problems in Northeastern apples, but we still need to conduct more extensive tests to accurately measure their usefulness.

Commercial use of postharvest $CaCl_2$ dips is rapidly occurring in many parts of the world, but not without problems. The $CaCl_2$ solutions are corrosive and may shorten the "life" of storage equipment and bins. Furthermore, while we detected no injury to 'McIntosh' and 'Baldwin'. and only very slight injury (flecks of calyx-end burn on a few fruit) to 'Cortland', it is known that serious damage can occur. Our tests should help considerably in understanding how to optimize the use of postharvest dips and minimize these problems of corrosion and possible injury to the fruit. The principles involved seem to be simple:

1. Natural openings (holes) must exist in the apple surface for Ca entry. The more holes (open lenticels, open calyx, etc.) there are, the more Ca will be absorbed from a treatment.

2. Absorption is almost entirely from residue following the dip. The only role of the dip is to produce a residue (which, incidentally, is not considered harmful to consumers), and normal variables of dip conditions seem to have no influence on this residue.

3. The humidity in the storage is a factor to be carefully considered. If a storage is maintained at 95% R.H., as is usually recommended, dips will probably be more successful than if the R.H. is lower, because absorption will continue over a long period of time -- as long as the residue remains liquid.

4. The key factor is the concentration of $CaCl_2$ used in the dip solution. Different varieties and different conditions will produce different amounts of Ca absorbed into the apple flesh from a given $CaCl_2$ concentration. Use of 4% $CaCl_2$ (32 lbs/100 gal) can probably be expected to produce significant gains in Ca under a wide range of conditions, but 1.5% or 2% (12 or 16 lbs/100 gal) $CaCl_2$ is probably sufficient under many conditions.

If treatment is employed judiciously, it is probably not necessary to use the very high $CaCl_2$ concentrations (24-32 lbs/100 gal), and therefore, potential problems can be minimized. Several Massachusetts growers who tested $CaCl_2$ dips on small lots of 'McIntosh' and 'Cortland' apples in 1975 incurred no problems and were pleased with the results. We hope that considerably more experience will be obtained this year so that this promising approach to improved storageability of apples will be more clearly understood and more widely applicable.

****

MARKETING MARGINS FOR McINTOSH AND RED DELICIOUS APPLES

Robert L. Christensen
Department of Food and Resource Economics

A study recently published by agricultural economists at the University of Connecticut focused on the determination of wholesale and retail marketing margins for apples.[1] Producers interested in performing this marketing function themselves through roadside stand operations should find this study of interest in making such a decision.

Apple growers have at least three alternatives for selling their fresh apples: (1) through their own roadside outlet, (2) selling direct to a retail outlet or (3) selling to a wholesaler. Many growers use a combination of all three.

McIntosh and Red Delicious were the two varieties selected for the study. The package studied was 12-3's. The data consisted of 238 observations of prices in 1969-70 for U.S. No. 1 or better apples. Considerable variability of prices was observed both in terms of variety and stage of marketing.

Wholesale Markups

Wholesalers of McIntosh apples apparently applied a constant markup which was then "adjusted" by the farm price. The constant factor was found to be $2.10 (for the 12-3 package). The adjustor operated in such a way as to reduce the margin when farm prices are high and increase it when the farm price falls. The adjustment factor was 21 percent of the farm price.

For example:

Farm Price in Period 1	$4.00
Constant Factor-Wholesale	2.10
Adjustor (.21 x 4.00)	-.84
Wholesale Markup	$1.26
Farm Price in Period 2	$5.00
Constant Factor Wholesale	2.10
Adjustor (.21 x 5.00	- 1.05
Wholesale Markup	$1.05

Wholesalers of Red Delicious used the same strategy in marketing. However, the constant factor was $2.06 and the adjustor was 18 percent.

---

[1]Montero, Jose, and D.G. Stitts, "Marketing Margins for McIntosh and Red Delicious Apples in Connecticut." Journal of the Northeastern Agricultural Economics Council, Vol. IV, No.2, October, 1975.

Retail Markups

Retailers of McIntosh apples used a different strategy in establishing markups. They add a constant factor plus a percentage adjustor (as contrasted with wholesalers where the adjustor was subtracted). This strategy leads to lower retail margins when farm prices are low and higher when farm prices are high.

The constant factor used by retailers tended to be $2.28 with an adjustor of 37 percent of the farm price. (This is, of course, in addition to the wholesale margin.) For example (using data from the previous example):

Farm Price in Period 1	$4.00	
Wholesale Markup	1.26	
Price to Retailer	$5.26	
Constant Factor-Retail	$2.28	
Adjustor (.37 x 4.00)	1.48	
Total Wholesale Markup	$3.76	
Total Price at Retail		$9.02
Farm Price in Period 2	$5.00	
Wholesale Markup	1.05	
Price to Retailer	$6.05	
Constant Factor-Retail	$2.28	
Adjustor (.37 x 5.00)	+1.85	
Total Wholesale Markup	$4.13	
Total Price at Retail		$10.18

Retailers of Red Delicious apples also followed the same markup practices. The constant factor was $3.70 and the adjustor was 25 percent.

Conclusions

"Given these types of markups, as supply increases, per unit wholesale markup increases, while per unit retail markup decreases. Therefore, in a period of overproduction, growers may find it profitable to bypass the wholesale, depending on how much it would cost them to do this." -- (Montero and Stitts)

Wholesalers and retailers marketing margins are based, at least in part, on their costs of performing the marketing function. Thus, when a grower takes on the job of wholesaling and retailing, he too must assume those costs. To assess the profitability of taking the role of a wholesaler and/or retailer involves consideration of several factors. The basic decision criteria is the answer to the question: "Can I perform the marketing functions at a cost lower than charged by firms in the marketing system?"

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
A. A. Spielman
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914

Official Business

Penalty for Private Use, $300.

POSTAGE AND FEES PAID

U. S. DEPARTMENT OF

AGRICULTURE

AGR 101

BULK THIRD CLASS MAIL PERMIT

FRUIT NOTES

PREPARED BY
DEPARTMENT OF PLANT AND SOIL SCIENCES

COOPERATIVE EXTENSION SERVICE, UNIVERSITY OF MASSACHUSETTS, UNITED STATES DEPARTMENT OF AGRICULTURE AND COUNTY EXTENSION SERVICES COOPERATING.

EDITORS
W. J. LORD AND W. J. BRAMLAGE

Vol. 41 (No. 6)
NOVEMBER–DECEMBER 1976

TABLE OF CONTENTS

Issued by the Cooperative Extension Service, A. A. Spielman, Director, in furtherance of the Acts of May 8 and June 30, 1914; University of Massachusetts, United States Department of Agriculture and County Extension Services cooperating.

INTERREGIONAL COOPERATIVE RESEARCH IN FRUIT TREE VIRUSES AND ASPECTS OF CONTROL MEASURES: I.HISTORY

R.C. McCrum
Department of Botany and Plant Pathology
University of Maine

Writing an article pertaining to U.S. apple virus research efforts, following the very informative article by Dr. van Oosten on the Netherlands fruit tree research in the Nov-Dec, 1975 Fruit Notes, is quite a challenge. The Netherlands' success with its system of distribution of nuclear stock coupled with the nursery management system of inspection and regulations has set an extremely difficult path for us to follow. Free American enterprise and its competitive economics does not always furnish the best vehicle in which to carry out a system of plant virus controls. This is illustrated in the recent concern over the impending influenza virus epidemic and governmental concern and action in instituting a national program of vaccine distribution and inoculations. Disease pathogens are unfortunately not considerate of the political aspects of a free laissez faire system. We presently lack the necessary controls needed to control the distribution of virus-indexed material along with inspections and cooperative nursery management that has led to the success attained by the Netherlands and other countries in speeding up their fruit tree virus control programs.

The U.S. has come a long way in the last few years in obtaining knowledge regarding fruit tree viral and mycoplasmal pathogens. In so doing, we have established quarantine restrictions on imports to exclude some serious systemic fruit tree diseases from entering the U.S. This in turn has led to a superior product which must be imported to U.S. buyers. At the same time, however, it has also required cleaner, virus-free material to be produced in the U.S. when we desire to export our apple tree material to other countries.

Fruit tree virus research in the United States received increases in support and importance in 1955 when the federal government in cooperation with the separate experiment stations initiated projects on tree fruits in the Cooperative Regional Research Projects. At first, there were 3 regional fruit tree virus projects: a Northeastern, a Central and a Western group. At present, the Northeastern group is the only one that is active. Other regions still cooperate but not on an active formal basis. Incorporated into the regional approach to fruit tree viruses was an interregional (IR-2) project and its coordinating committee whose purpose was to establish, obtain, and preserve virus-free deciduous tree fruit materials. By 1958, after 3 years of operation, the IR-2 project had established facilities for research work and indexing at the Irrigation Experiment Station at Prosser, Washington. At the same time, there were plots established adjacent to the Washington State Plant Quarantine station near Moxee, Washington where virus-free cones could be maintained for budwood and seed

sources. Technical committee members elected from each region as well as their administrative advisors formed a working advisory board for the IR-2 fruit tree repository. At first, emphasis was given to stone fruit problems only and the repository had received up to 1960 a total of 472 candidate clones submitted for consideration. The spring of 1960 saw 13 virus free clones planted in isolation at the Moxee site. Extensive therapy of budwood of varieties in which no clean propagating material could be found was begun in 1960-61. In 1964, initial release of several _Prunus_ selections was authorized as a result of this work.

Starting in 1963, work on pome fruit viruses was included in the interregional and regional projects. A subcommittee was set up for the new apple and pear work and they immediately reported out a project to find suitable indicators for virus indexing. Annual reports of 1964 revealed that 15 indicators and 92 sources of virus-infected and healthy apple collections were being tested at the Indiana and the New York (Geneva) Experiment Stations. These tests were undertaken to find more sensitive indicators to both the latent and fruit distorting virus entities. Also included at that time were indicators such as the Russian indicator R-127407, _Malus platycarpa_ and Virginia Crab. Mechanically inoculated herbaceous indicators were also used to identify and screen out other possible contaminating entities in apple and pear budwood sources. In the meantime, work with pome fruits had already been initiated at several stations and became dovetailed with the IR-2 endeavors. The consent to officially start work at the IR-2 repository on pome fruits was given in 1965 and at that time 37 candidate clones were assembled for further testing in screenhouse tests at the Washington Station. Additional _Malus_ clones were also received at the repository that had been initially screened at individual cooperating stations, and by other workers concerned with maintaining a virus-free repository of budwood. Thus, after 10 years of work on _Prunus_, 1965 also saw the beginnings of a collection of virus indexed apple clones established in the interregional repository. In response to the U.S. success of the IR-2 project in establishing screenhouse nuclear stocks and isolated fruit tree plantings, other countries initiated similar repositories modeled after the IR-2 development.

By 1969, provisions were made to include patented cultivar selections in the repository along with proper restrictions and permission from the patent holder allowing experimental manipulation and incorporation of the cultivar in the repository. This was deemed necessary because many of the newer and most important commercial apple cultivars used were the patented ones. In 1971, the release of indexed apple budwood under the regional and IR-2 project working groups was started. A distribution list of 66 clones was available and 900 buds of 59 selections were formally released to 9 research and regulatory scientists. At the time, a number of states including Maine, made use of this indexed IR-2 budwood to form mother block trees for use in orchard and nursery improvement projects.

By 1975, the success of the continuing IR-2 and regional projects was demonstrated by examining the records for the release of material from the repository. In 1975, 18,960 Prunus, 3115 Malus and 1600 Pyrus buds representing respectively, 640, 122, and 76 cultivar selections were released to 53 research or regulatory scientists. In addition, indexed budstocks of 21 patented selections in the repository were returned to commercial contractors. The latter distributed material represented the first release of incorporate patented budwood material.

Up to 1975, repository material has been distributed by requests to 193 research or regulatory scientists, representing 34 states, 4 Canadian provinces and 33 foreign countries.

(To be continued in Jan-Feb, 1977 issue.)

****

PUBLICATIONS AVAILABLE

Available from the Cooperative Extension Service, Michigan State University, East Lansing, Michigan 48824, for $1.00 is Extension Bulletin E-791, entitled "Problem Perennial Weeds." This publication contains excellent color photographs of problem perennial weeds in Michigan. Since many of these weeds are also found in our tree and small fruit plantings in Massachusetts, this publication will be valuable for their identification.

"Management of Pick-Your-Own Marketing Operations" is a recent bulletin of the Northeast Extension Marketing Committee, published by the University of Delaware. Its 66 pages cover all aspects of PYO operations and should be of special interest to fruit growers who are contemplating or who are currently using this method of sales. A copy may be obtained by sending $2.50 to the Agricultural Bulletin Room, University of Delaware, Newark, Delaware 19711.

****

NEMATODE CONTROL AND APPLE TREES

R.A. Rohde
Department of Plant Pathology

Plant-parasitic nematodes occur in all soils and have been shown by many workers to be the cause of root injury to virtually all plants, including apple trees. The result of feeding by these

microscopic worms may be a reduction in overall growth of any sized-trees but the problem is most evident in newly planted blocks that fail to develop uniformly.

The nematode species most often associated with poor growth of apples in the Northeast is the meadow nematode, Pratylenchus penetrans. This parasite is also called the lesion nematode because adults and larvae burrow through the root cortex, breaking down cells and causing tissue collapse. The initial cavities or spots become infection courts for numerous fungi and bacteria which complete the breakdown of the roots. Populations build up fastest in lighter soils, or at least injury seems to be more severe in sandy and sandy loam soils but this is not always the case.

The other nematode species most often found feeding on apples are ectoparasites, meaning that they remain in the soil. Their surface feeding does not cause extensive tissue breakdown but can contribute to reduced root growth.

Poorly developed root systems lead to a variety of symptoms. Water is not absorbed efficiently and trees become stunted. Marginally available nutrients become limited. Poor growth leads to poor winter hardiness. Dagger nematodes, one of the ectoparasitic species, are transmitters of peach viruses and may possibly transmit apple viruses as well.

Experimental evidence that nematodes injure apples is usually obtained either by adding nematodes to seedlings growing in pots or else by treating larger trees with chemicals called nematicides and comparing them with untreated trees. A number of general conclusions may be drawn from the research literature in the U.S. and Europe.

1. The presence of nematodes does not always mean that chemical treatment will lead to increased yields. Healthy trees, growing vigorously, can support relatively large numbers of nematodes and are unlikely to grow better with treatment.

2. Treatment is usually profitable only when there is evidence of poor root growth or reason to suspect that there might be. Soil should be sampled and analyzed for nematodes but at the same time, nutrient levels, drainage, hardpan and other soil conditions should be checked out.

3. The younger the trees, the better the chances for success from chemical treatments and for all practical purposes, nematode control should be done in conjunction with planting. It is far easier to prevent infection than to try and get rid of nematodes already in the roots.

4. The head start given to young trees will usually last for the life of the tree even when nematode populations build up later.

Chemicals used for control are classified as either fumigants or contact nematicides. The chemicals mentioned are those listed in the EPA compendium, but before using, the grower should check with the Regional Fruit Specialist.

Fumigants - are liquids that, when injected 6-8" deep in soil, turn into a gas which penetrates the soil mass. These chemicals are toxic to all forms of life including nematodes, insects, fungi and apple trees. They are used before planting and do not work properly unless old roots and plant materials are removed, soil temperatures are above 50°F and the soil is worked up to "seedbed condition." Standard soil fumigants are formulations of either dichloropropene (Shell D-D*, Telone*, Vidden-D*) or ethylene dibromide (Dowfume W-85*). The fungicidal activity of dichloropropene is increased with the addition of chloropicrin to make Telone-C* or methyl isothiocyanate to make Vorlex* or both chloropicrin and methyl isothiocyanate to make Vorlex-201*. The increased growth responses from the broader spectrum compounds are largely unexplained but nonetheless profitable.

Contact nematicides - are liquid or granular formulations that can be used on nursery or other trees during a nonbearing year. Only two chemicals are presently registered for apples: Zinophos* as a bare root dip during planting and oxamyl (Vydate-L*) as a preplant soil treatment, a foliar spray or a root dip.

Both are highly toxic to humans and both will have some systemic insecticidal activity. Both work best when used to prevent infection and are part of an overall control program.

It is important to start with clean planting stock, preferably produced on fumigated soil with any type of replanting program. Lesion nematode populations decline with cover crops of sudangrass, perennial ryegrass or fescue, and one or two cover crops combined with plowing to get rid of old tree roots will greatly improve the results from fumigation. Time-of-planting treatments work best when coupled with fumigation and both work best when integrated with the cultural procedures described above.

Because nematode control is expensive and takes a lot of care to do properly and because every orchard soil is different, it will be important to proceed with caution. In Massachusetts, most fumigation is done by custom applicators who are able to meet specialized needs. Enough evidence exists to show that in many cases, however, it could be a profitable venture.

*Trade name

****

STICKY RED SPHERES FOR TRAPPING APPLE MAGGOT FLIES

Ronald J. Prokopy
Department of Entomology

In the last issue of Fruit Notes, I discussed the visual and odor cues that guide apple maggot flies to insect honeydew, their principal source of food. I mentioned that the honeydew accumulates principally on tree leaves, and that both the color of leaves, as well as the odor of honeydew are attractive to the flies. I also briefly described experiments which showed that daylight fluorescent yellow paint is, to the flies, the equivalent of super-bright and therefore super-attractive foliage, and that small sticky-coated rectangles painted this color are effective in attracting and capturing flies which are in a feeding mood. Ammonium acetate and protein hydrolysate emit odors which are apparently similar to the odors emitted by honeydew, and these materials, when added to the yellow rectangles, further enhance their effectiveness in capturing food-seeking maggot flies.

To infest apples, apple maggot flies must of course not only find food but also succeed in finding mates and apples in a stage susceptible for egglaying. In this article, I wish to briefly describe some of the research which I (alone, or in conjunction with Guy Bush of Texas and Volker Moericke of West Germany) have been doing in recent years to determine how these flies find mates and apples. This research has yielded a trap which from mid-season on, is even more effective than the odor-baited yellow rectangles in capturing and monitoring fly populations in commercial orchards.

Apple maggot females must mate in order to lay fertile eggs. We have found that the site of mating is exclusively the fruit of the larval host plant. The original larval host of the apple maggot, an insect native to North America and not found elsewhere, is hawthorn.Apples were introduced into the U.S. from Europe by early pioneers about 350 years ago. About 110 years ago, the apple maggot shifted from hawthorn onto apples, and about 20 years ago it shifted onto sour cherries in Wisconsin. Thus, the mating site of the flies is the fruit of hawthorn, apples and sour cherries.

How do the males and females locate fruits favorable as mating and egglaying sites? We have found that the odor of apples in a stage suitable for egglaying, in combination with the general visual stimulus of apple tree color, size and shape, attracts both sexes of flies to apple trees. If the apples on a tree are not ripe enough for egglaying, or if they're too ripe, then their odor does not attract the flies. After the flies arrive on an apple tree, both sexes locate the individual fruits principally, if not exclusively, by vision. I showed this by hanging wooden models of ap-

ples (the same color, size, and shape as real apples) near real apples on a tree and observing that just as many males and females landed on the wooden models as on the real apples.

What then are the particular visual characteristics of individual apples which the flies cue in on? I found that the spherical-type shape of an apple is a very powerful visual stimulus, and that wooden spheres attract many times more flies than wooden cubes, cylinders, or rectangles of the same color and size. Color is also important, the most preferred colors of wooden, apple-size spheres being red and black, the least preferred being light green, light orange, and yellow. My interpretation of this is that dark-colored fruits stand out in greater contrast (and are thus more readily detectable) against the background of tree foliage and skylight than are light-colored fruits. Just as humans would, so also would the flies eventually discover all the yellow or yellow-green apples on a tree. But the flies, as well as humans, have an easier time locating dark-colored apples. Size of apple is another important stimulus to the flies. They are not as attracted to small apples, one inch or so in diameter, as they are to 3-inch-diameter apples. Early in the season, they are just as attracted to red spheres 12 inches in diameter (only in Texas do apples grow so big!) as to ones 3 inches in diameter. But as the season progresses, the flies apparently learn, through practice and experience, the normal size of apples, so that by mid-season, they show a decided preference for 3-inch red spheres over 12-inch ones.

After an apple maggot male arrives on an apple, it waits there, visually searching the vicinity for the presence of a female. Recently, I found that virgin females are attracted from a short distance to a sex odor given off by the males. Also, we found that when a female visits an apple, it lays down an odor of short duration (2-3 hours) that acts to arrest a male arriving on that apple. This odor lets the male know that a female has recently been there, and that it would pay the male to wait there and watch for the female.

What practical use can be made of this information to aid in our apple maggot control programs? It turns out that a very powerful visual trap for attracting and capturing the flies can be made simply by painting a bocce or croquet ball (3-4 inches in diameter) dark red, coating it with Bird Tanglefoot* (manufactured by the Tanglefoot Company, Grand Rapids, Michigan) and hanging it by wire in an apple tree of a maggot-favored variety - Astrachan, Wealthy, Puritan, Early McIntosh, Cortland, Delicious, Spy. This ball or sphere effectively mimics the visual stimulus of an apple, and is highly attractive to male apple maggot flies in a mating mood and to females in a mating and egglaying mood. It is extremely important, however, that the flies be able to clearly see the sphere.

*Trade name

All foliage and fruit within 12 inches of all sides and top and bottom of a sphere should be removed. But beyond this distance, there should be as much fruit and foliage as possible to attract flies into the general area. The sphere should be hung at head-height or higher.

This past summer, Everett Wilder and Dom Marini (regional fruit specialists in Massachusetts) and I hung 1-4 of these unbaited sticky-coated red spheres plus 1-4 baited sticky-coated daylight fluorescent yellow rectangles in each of 9 commercial apple orchards in Massachusetts to monitor the activities of apple maggot flies. We found that early in the fly season (up to July 10), when the flies had a high drive to feed, the rectangles generally attracted slightly more maggot flies than the spheres. But after that time, as the flies matured and developed a higher drive to mate and lay eggs, the spheres became 2-15 times more attractive than the rectangles. This was true even though the rectangles were usually freshly renewed every 3 weeks, while the spheres remained unaltered.

We captured mature apple maggot females on the spheres in 8 of the 9 commercial orchards, in some cases as many as 5 females/week/sphere. Because the flies are unable to perceive the spheres at a distance greater than about 1 yard, these captures suggested that other uncaptured maggot flies were probably present in the immediate vicinity, constituting an egglaying threat to the apples. Protective maggot sprays were therefore advisable. Sphere capture data proved especially helpful toward the end of the season, when there was uncertainty as to when to stop spraying for maggot. In at least 2 orchards, considerable numbers of mature females were captured after mid-August, and as a result, an additional protective spray was applied to Cortlands and Delicious.

Maggot can be a serious pest, the average female capable of laying 300 eggs, and therefore stinging and infesting 300 fruits. All growers, especially those having early-season varieties, should be aware of the potential destructiveness of this insect. In fact, this year in 2 of the best commercial orchards in Massachusetts, we found substantial numbers of fallen Wealthies and Puritans infested by fully developed maggot larvae. In these and other orchards, we also observed maggot egg-laying stings and early larval development in some Cortlands and Delicious.

Just as the unbaited red spheres are effective in monitoring apple maggot populations, they also are of real usefulness in directly controlling the flies in small orchards of about 100 trees or less. For example, in my own insecticide-free, 150-tree orchard in Wisconsin in 1974, I hung 6 of these spheres in each fruiting tree and captured more than 9500 apple maggot flies. If uncontrolled, this number of flies would have given rise to about 30 eggs/apple in my orchard. But I received an average of fewer

than 2 eggs/100 apples, clearly demonstrating the effectiveness of the spheres in directly controlling the flies before much egg laying was underway. The amount of labor required to prepare and emplace the number of spheres required for directly controlling the maggot (about 6 spheres/standard-size tree) would be prohibitive in an orchard larger than 150 trees.

At present, we a U. Mass., in conjunction with other scientists from Geneva, New York, are aiming to improve the effectiveness of the sphere trap still further by attempting to identify and then synthesize the fly-attracting components of apple fruit odor and male sex odor. This work will require at least 2-4 years. If successful, it will mean that we should be able to bait the spheres with these synthesized odors, and have a trap whose range of effectiveness extends beyond the one yard or so at which unbaited spheres are attractive.

In the next issue of Fruit Notes, I will discuss a unique sort of behavior engaged in by the apple maggot just after egglaying. This behavior, and the fly-originating chemicals associated with it, offers promise as a new means of controlling the apple maggot without insecticide in large commercial orchards.

****

FRUIT NOTES INDEX FOR 1976

(This index of major articles has been prepared for those who keep a file of Fruit Notes. The number in parenthesis indicates the pages on which the item appears.)

****

All pesticides listed in this publication are registered and cleared for suggested uses according to Federal registrations and State laws and regulations in effect on the date of this publication.

When trade names are used for identification, no product endorsement is implied, nor is discrimination intended against similar materials.

NOTICE: THE USER OF THIS INFORMATION ASSUMES ALL RISKS FOR PERSONAL INJURY OR PROPERTY DAMAGE.

WARNING: PESTICIDES ARE POISONOUS. READ AND FOLLOW ALL DIRECTIONS AND SAFETY PRECAUTIONS ON LABELS. HANDLE CAREFULLY AND STORE IN ORIGINAL LABELED CONTAINERS OUT OF REACH OF CHILDREN, PETS AND LIVESTOCK. DISPOSE OF EMPTY CONTAINERS RIGHT AWAY, IN A SAFE MANNER AND PLACE. DO NOT CONTAMINATE FORAGE, STREAMS AND PONDS.

Establishment and Management of Compact Apple Trees

William J. Lord and Joseph Costante[1]
University of Massachusetts

Part 1

Introduction

This information has been prepared for the purpose of discussing the establishment and management of compact apple trees and will appear in serial form in this publication. It is hoped that both the experienced and novice orchardist will find some useful guidelines in the following pages. Certain management aspects, such as orchard fertilization and pest control, are not fully covered because the subject matter is discussed in detail in other publications.

The inflationary spiral has forced apple growers to explore every possible means of increasing production per acre and per man hour. Small trees on size-control rootstocks (compact trees) in comparison to large trees on seedling roots, can be more economically pruned, sprayed, and harvested. Compact trees, properly spaced, produce more bushels per acre and reach maximum production at an earlier age than larger trees. However, compact trees do not guarantee fruit growing success.

Much remains to be learned about compact apple trees in Massachusetts because our studies thus far have been very limited. In this publication, we rely heavily on observations, experience, and trials in commercial orchards.

Economics

The size of the orchard is not a major factor determining efficiency in producing apples. Net returns per acre are often as high on small enterprises as on large ones. However, the large operators are able to use capital in the form of air blast sprayers, weed sprayers, dip tanks for scald control and other specialized equipment more effectively than small operators. Thus the labor efficiency may be higher and costs per acre lower for operating these types of equipment on a large operation than a small operation.

Growing costs, yields and prices received are variable and reflect how differently growers are managing their businesses. Cost inputs in apple orcharding should be viewed with some skepticism for several reasons. These reasons have been reviewed by R.L. Christensen.[2] Nevertheless, the cost figures in Tables 1, 2, 3 and 7, are representative of the orchards studied here and in New York State and give the reader an insight of the cost factors in apple production.

Site preparation and planting costs. The labor requirements and costs of removing old apple orchards and replanting in 1973 are shown in Table 1. Soil preparation in the low density planting included tree and stump removal, liming, land

Table 1. Man hours and cost[z] per acre to remove an apple orchard and establish a low, medium or high density planting in Massachusetts, 1973.

Item	Low density (109 trees/A) Hrs.	Low density (109 trees/A) Cost	Medium density (200 trees/A) Hrs.	Medium density (200 trees/A) Cost	High density (389 trees/A) Hrs.	High density (389 trees/A) Cost
Orchard removal	56	$429	32	$514	33	$327
Soil preparation	10	113	13	145	33	290
Trees	–	191	–	340		640
Posts	–	–	-	–	–	367
Marking	6	32	12	53	24	92
Planting	4	40	10	99	9	77
Post setting and tying	–	–	–	–	26	102
Totals	76	$805	67	$1151	125	$1895

[z]Excludes only cost of land and interest on investment in land.

[1] Formerly Regional Fruit Specialist in Massachusetts. Present address: Department of Plant and Soil Science, University of Vermont, Burlington, VT 05041.

[2] Christensen, R.L. 1976. "Cost of Production," *Fruit Notes* 41(1): 1-3.

Table 2. Cost per acre[z] for establishing and growing apple orchards in Massachusetts for the first three growing seasons, 1973–1975.

Trees/A	Cost of preparing and planting site	Growing cost 1st yr.	Growing cost 2nd yr.	Growing cost 3rd yr.	Total cost
109	$ 805	$156	$219	$202	$1382
192	1082	198	187	277	1744
200	1151	223	165	266	1805
389	1895	366	253	308	2822

[z]Excludes only cost of land and interest on investment in land.

Table 3. Projected cost to remove an existing orchard, replant and manage for the first four growing seasons.[z,y]

Trees/A	Planting and growing years 1976-79	1977-80	1978-81	1978-82
75	$1673	$1791	$1919	$2050
100	2032	2174	2326	2488
125	2252	2410	2579	2758
150	2421	2590	2771	2965
175	2556	2735	2927	3132
200	2641	2826	3024	3236
225	2869	3069	3283	3512
250	3083	3298	3527	3773
275	3267	3495	3739	4000
300	3462	3705	3965	4242
325	3661	3917	4191	4485
350	3846	3636	4401	4709
375	4002	4285	4586	4908
400	4179	4472	4784	5118
425	4299	4601	4924	5269
450	4396	4704	5034	5387
475	4524	4841	5179	5542
500	4565	4884	5226	5591

[z]Assuming annual inflation of 7%.

[y]Excludes only cost of land and interest on investment in land.

leveling, and stone removal. Similar procedures were followed in the other plantings except the medium density (200 trees/A) required filling in low areas with stone and soil and the high density planting was tile-drained.

Open fields can be less costly to plant to orchards because of the high labor requirements of removing an old existing orchard (Table 1). However, it would not be unusual today to spend $1000 per acre to clear and prepare a stony, wooded area for planting.

The number of trees and the need of posts for the high density planting had a very significant influence on the cost of establishing the orchards (Table 1). Establishment costs increased with tree density but data from other areas[3,4] indicate that compact trees in medium and high density plantings in comparison to low density plantings, if properly matched in regard to spacing, scion/rootstock combination, and soil, will give a quicker return of the investment.

[3] Funt, R.C. 1975. "High Returns for Higher Density," *American Fruit Grower* 95 (No. 12): 22-23.

[4] Norton, R.L. 1975. "Rootstocks: Promises and Problems--Practical Aspects," *N.J. State Horticultural News.* 56 (No. 2):10-12, 16, 18-19, 24-25.

Orchard development costs. Our data for orchard development costs are limited to three growing seasons (Table 2). Spray costs were the largest single cash item in the second and third development years. The two major components of costs in growing a crop will become labor and spray (including dust materials) as the orchards increase in age. Training and pruning will require the most labor of any job in growing apples, thus the interest in compact trees which, among their other attributes, require less pruning time than larger trees.

The cost of doing business is increasing annually. Assuming an annual inflation rate of 7%, projected costs to remove an existing orchard in 1976, 1977, 1978 or 1979, to replant and manage for the first four growing seasons are shown in Table 3. The figures show, for example, that it would cost \$2826/A to remove an existing orchard in 1977, establish a new planting with 200 trees/A and manage them through 1980. A four year delay (1976 to 1979) can increase the per acre cost by approximately \$1000 in plantings of 400 to 500 trees/A. In view of these high investment costs, success in apple production will be very dependent upon: (1) using the best information available in the selection of orchard site, cultivars, rootstocks, and spacings; (2) obtaining early yields for a quicker return on the investment; and (3) high annual yields of high quality fruit per acre and per man hour.

Yields. Trees on M.9, M.26 or interstem trees with M.9 as the intermediate stem piece produced a few fruit in third growing season but not enough to warrant harvest in the orchards under study (Table 4). By the fifth growing season, crop returns from a high density planting on M.9 probably surpassed production costs (Table 5). Standard-type trees on M.7 or MM 106 failed to produce sufficient apples to warrant their harvest until the fifth or sixth growing season.

Our observations and the limited data in Table 5 show that Delicious are generally slower coming into production than McIntosh but planting spur-types and/or the use of MM 106 rootstock may induce earlier bearing.

The productivity of cultivars on M.7 increases rapidly and by the eighth year cultivars on this rootstock are capable of producing more than 500 bushels per acre (Table 6). In spite of the greater tree number of Golden Delicious per acre in comparison to McIntosh and Delicious, the yields were relatively similar.

The authors believe that the McIntosh yields could be considered average for a commercial orchard but the yields of the Delicious above average. Furthermore, at the spacings indicated in Table 6, the trees may have reached their maximum bearing potential.

Unfortunately, data as presented in Table 6 are not available in Massachusetts for cultivar performance on other rootstocks. Data from other areas indicate that high density plantings will produce higher, earlier yields and greater cumulative yields than the low or medium density plantings in Table 6.

Cost of producing and harvesting apples. Data for cost of producing and harvesting apples in Eastern New York State in 1973 through 1975 are shown in Table 7. Costs and yields in Massachusetts would be relatively similar.

The data are based on a survey in six orchards in which the growing costs were divided into five categories—orchard overhead, management, labor, equipment, and materials. Orchard overhead includes real estate taxes, an interest or return on investment charge on land in bearing orchards and buildings used in growing, and rental of land and buildings not owned. Where buildings also were used for other purposes, an allocation was made. The interest charge (5% in 1973, 7½% in 1974 and 1975), which is a non-cash expense on the proportion of the land and buildings not mortgaged, represents a return on the investment.

Management costs include owner and/or manager's salary, accounting, secretarial and office expense. The owner was paid out of the farm business for tasks including among others, deciding when and what to spray, buying equipment, attending meetings, and overseeing other workers.

Labor includes the expense for pruning, spraying, mow-

Table 4. Production in 1975 on several cultivars on different rootstocks in trial plantings in grower orchards in Massachusetts. Trees planted in 1973.

Cultivar	Rootstock	Spacing (feet)	Yield lb./tree	Yield Bu./A
McIntosh	M.9	8 x 14	4	37
Idared	M.9	8 x 12	2	24
Tydeman	M.9	8 x 12	2	24
MacSpur	M.26	14 x 18	3	12
Jerseymac	M.26	14 x 18	5	22
Empire	M.26	14 x 18	2	7
McIntosh	M.9/MM 106	12 x 18	2	10
Macoun	M.9/MM 106	14 x 20	2	7
Spartan	M.9/MM 106	14 x 18	2	7
Empire	M.9/Alnarp 2	14 x 18	3	14

Table 5. **Production on several cultivars of young apple trees on different rootstocks in Massachusetts.**

Orchard	Cultivar	Rootstock	Trees/A	Bu./A in growing year^{Z} 3	4	5	6
1	McIntosh	M.7	113	–	23	104	399
2	McIntosh	M.7	113	–	–	69	138
3	McIntosh	M.7	113	–	–	46	104
4	MacSpur	M.7A	140	–	42	126	?
5	Delicious	M.7	113	–	–	–	81
6	Spur Delicious	MM 106	113	–	34	?	?
7	McIntosh	MM 106	93	–	38	95	190
8	McIntosh	M.9^{Y}	340	34	68	238	442
9	Spartan	M.9^{Y}	340	34	136	238	442

^{Z}Yields were recorded in research trials and then calculated to yields per acre based on planting distances suggested in this publication.

^{Y}Trellised.

Table 6. **Productivity of apple cultivars on M.7 rootstock at the Horticultural Research Center, Belchertown, Massachusetts.**

Growing year	Production (bu/A)^{Z} McIntosh (113 trees/A)	Delicious (113 trees/A)	Golden Delicious (141 trees/A)
8	550	628	423
9	528	704	823
10	614	595	580
11	791	721	605
12	639^{Y}	510^{Y}	620
13	1464^{X}	982	720
Cumulative (8 to 13 years)	4586	4140	3771

^{Z}Yields were recorded per tree and then calculated to yields per acre based on planting distances suggested in this publication.

^{Y}Yields reduced by frost.

^{X}Trees should have been thinned.

ing, and other growing practices plus the employer's share of social security and workmen's compensation. When the owner and/or manager performed any of the cultural tasks, the time was figured at an hourly rate, for example, $4.50/ hour in 1975.

Depreciation, fuel, repairs, and an interest charge on the investment in equipment, whether fully paid for or not, were included in equipment costs. Materials costs include the cost of spray and dust materials, lime, fertilizer and other items used in production.

The growing costs (Table 7) increased 24% from 1973 to 1974. A 31% increase in growing costs occurred in 1975, partly due to the sizeable increase in the category of orchard overhead because of increased land value and to gradual grower realization of the large amounts of money invested in orchards. Cost/bushel increased in 1974 and 1975, in spite of the higher yield. Harvesting costs/bushel did not increase in 1975 in comparison to 1974 because the fixed costs involved in harvest were spread over a larger number of bushels in 1975 and the "piece rate" for picking did not increase.

Recycling Orchards

Formerly, growers kept a block of trees 40 years or more. We now believe it is worthwhile to replace trees in an orchard sooner because: (1) fruit quality is generally higher on younger mature trees; (2) fruit can be produced more economically on smaller trees; and (3) it presents the opportunity to use the latest technological advances in orcharding more frequently. Therefore, renewing 25% of one's orchard holdings every five or six years is a practice worthy of consideration.

This allows the oldest orchard block never to exceed 24 years of age.

Planting Trees in an Existing Orchard

Growers frequently desire to renovate existing orchards to avoid loss of production. The practice of planting among existing trees is not recommended. It is difficult to plant the compact trees at the desired spacing in an established orchard without encountering tree shading and/or crowding, and difficulties in performing necessary cultural practices. Furthermore, past experience has shown that the old trees are seldom removed before they seriously crowd and interfere with the development of the young filler trees.

The removal of an entire block of trees which permits site preparation and establishment of desired planting distances is the preferred practice, but the removal of several rows of existing trees is a suitable compromise. If the performance of the existing trees has been less than satisfactory, the soil, among other things, should be examined for the presence of nematodes. Contact your County Extension Service for information on soil sampling and soil preparation procedures.

Choosing Orchard Sites

The first consideration in choosing an orchard site is the selection of land with sufficient elevation to permit cold air to settle into the lower levels surrounding the orchard. Cold air is heavier than warm and tends to settle into the low spots. On a cold, still night, the temperature in valleys and low areas surrounded by higher land may be 5° to 10° colder than the more elevated locations. These temperature differences can mean the difference between a fruit crop and a complete crop failure. Too little attention to the selection of sites with sufficient elevation to avoid spring frosts and extreme winter temperatures can only result in loss of crops and eventual abandonment of the orchard. Sites which are surrounded by dense woods or other obstructions which impede the free movement of cold air out of the orchard should be avoided unless a path can be cleared which will allow the cold air to move to lower levels.

The direction of the slope for an orchard site is relatively unimportant. Southern and eastern slopes are a little better exposed to light, somewhat warmer and earlier, and have more protection from wind; northern and western slopes are slightly colder, later and subject to wind. However, northern and western slopes with good elevation are to be preferred to southern and eastern slopes with poor elevation.

Steep slopes of more than 15 percent should be avoided wherever possible as the danger of soil erosion is increased. It is also more difficult to move sprayers and other equipment through orchards on steep slopes.

Sites on tops of high ridges are unsatisfactory because of high winds which may affect tree shape, blow trees over, injure fruit and make spraying difficult. Slopes along the side of the ridges are often more satisfactory than the tops.

Sites which are extremely rough and covered with large stones will greatly increase the difficulty and expense of operation. Small areas of this nature adjacent to an existing orchard which can be smoothed and cleared of stones by heavy machinery without too much expense may be a sound investment. However, the cost of clearing rough, stoney land for a large extensive orchard is very likely to be prohibitive.

We strongly urge the novice fruit grower to contact the

Table 7. The cost of producing and harvesting apples in N.Y. State.[z,y]

Item	1973	1974	1975
Orchard overhead	$ 79.60/A	$ 94.31/A	$149.18/A
Management	39.32/A	50.68/A	58.32/A
Labor	97.77/A	115.36/A	132.56/A
Equipment	69.91/A	96.98/A	138.60/A
Materials	90.26/A	109.28/A	134.26/A
Total cost/A	$376.86	$466.61	$612.92
Yield/A—bu.	314	344	364
Cost/bushel	$1.20	$1.36	$1.68
Harvesting costs/bu.	0.74	0.84	0.84
Combined growing and harvesting costs	$1.94	$2.20	$2.52

[z] Forshey, C.G. and R. Lawrence. 1975. The cost of producing and harvesting apples in eastern New York in 1974. *Proc. New York State Hort. Soc.* 120: 132–134.

[y] Lawrence, R.T. 1976. A survey of the cost of growing and harvesting apples in eastern New York in 1975. *Proc. New York State Hort. Soc.* 121: 78–83.

County Extension Service for advice concerning the suitability of a site for orchards.

Orchard Soils

A good orchard soil is characterized as being deep, well drained and yet retentive of moisture. To put it another way, the soil should not be too wet nor too dry during the growing season. Soils which have heavy subsoils composed of fine soil particles have such small spaces between the particles that water does not drain out of the soil quickly following heavy rains. Oxygen, which is so necessary for root development and growth, is excluded from heavy, wet soils. Tree growth and fruit production is very poor on such soils. Tree roots can stand some submergence during the dormant season providing water drains away by the time growth starts in the spring.

An examination of the subsoil, by use of a back hoe or auger, at depths of 4 to 6 feet, will help determine whether or not the land is suitable for growing fruit trees. Subsoils which are mottled in color, with prominent gray streaks or have a compact gray layer close to the surface level, are poorly drained and should be avoided. On the other hand, subsoils which are composed of coarse gravel are too well drained and trees planted on this type of soil will suffer from drought.

The ideal orchard soil has a topsoil which is deep and well supplied with colloidal and organic matter. The subsoil is relatively light-textured and uniformly light brown in color, extending a depth of 4 to 6 feet.

Careful observation of the natural vegetation growing on or adjacent to the site selected for the orchard can be helpful in determining the suitability of the soil for fruit trees. Pitch pine and scrub oak indicate gravelly soil which is excessively drained and subject to drought. Swamp maple, alder, and willow indicate a soil which is poorly drained and excessively wet. Sugar maple and white ash do best on a deep fertile, well-drained soil of good water-holding capacity.

Matching Rootstock and Soil

Size-control rootstocks, in general, are more demanding than seedling rootstocks in respect to drainage, depth of soil, and water holding capacity. Therefore, when deciding on which rootstock to use, it is even more important than formerly to know the soil type(s) of the land to be planted. The proper match between rootstock and soil may be the difference between the success or failure of the planting.

The first step in matching the rootstocks and soil is to determine the soil type(s) for the land to be planted by referring to the soil map of your farm. If no soil map is available or if it is dated earlier than 1967, contact the Soil Conservation Office for the information. (Your local Agricultural Extension Service can tell you the location and telephone number of the Soil Conservation Service in your area.)

Once the soil type(s) is (are) known, determine which of six soil suitability groups[5] given below include your soil(s). *(The suitability groupings are based on soil characteristics and qualities. Site and air drainage are not considered. Therefore, some soils placed in the six groups may not be suitable for apple orchards because of the topographic positions they normally occupy.)*

Lastly, refer to the guide for rootstock/soil agreement in Table 8 to determine which rootstock(s) are most suitable for your soil(s).

Nothing takes the place of an on-site inspection by a soil scientist from the Soil Conservation Service because localized wet or droughty areas can exist within fields that have good, deep soils with good drainage. At best, the guide in Table 8 may prevent you from making some of the more obvious errors.

Group I—Light, gravelly or sandy soils with a tendency to drought.

- Copake fine sandy loam
- Enfield very fine sandy loam
- Gloucester loamy sand
- Hartford gravelly fine sandy loam
- Haven very fine sandy loam
- Merrimack fine sandy loam, sandy loam
- Riverhead sandy loam
- Warwick gravelly loam

Group II—Light, gravelly or sandy soils, without the tendency to drought.

- Agawam fine sandy loam
- Canton fine sandy loam
- Gloucester fine sandy loam, sandy loam
- Gloucester-Narragansett very fine sandy loams
- Katama sandy loam
- Narragansett very fine sandy loam
- Ondawa fine sandy loam, high bottom

Group III—Good deep soils with average to good drainage and a good waterholding capacity.

- Berkshire loam, fine sandy loam
- Berkshire fine sandy loam, dark subsoil
- Brookfield fine sandy loam
- Charlton fine sandy loam
- Cheshire fine sandy loam
- Colrain fine sandy loam
- Dutchess silt loam
- Hadley silt loam, high bottom
- Hadley very fine sandy loam, high bottom
- Hartland silt loam, very fine sandy loam
- Lenox loam
- Newport silt loam, loam
- Pittsfield fine sandy loam

Group IV—Good, but shallow soils, with hardpans that prevent deep rooting.

- Amenia silt loam, fine sandy loam

[5]The authors are indebted to John R. Mott, Ass't State Soil Scientist, USDA Soil Conservation Service, 29 Cottage St., Amherst, Mass. 01002, for preparing these groupings.

Table 8. An approximate guide of rootstock/soil agreement.

Rootstock	Soil group I	II	III	IV	V	VI
Dwarf						
M.9, M.9A, or virus-tested M.9			X			
Semi-Dwarf						
M.26		X	X	X		
Inter. M.9/Alnarp 2		X	X	X		
Inter. M.9/Seedling		X	X	X		
Inter. M.9/M.13				X	X	X
Inter. M.9/MM 111	X*	X	X	X	X	
Inter. M.9/MM 106		X	X	X		
MM 106		X	X	X		
M.7 or M.7A			X	X	X	
Vigorous						
Alnarp 2		X	X	X		
MM 111		X	X	X	X	
Seedling	X	X	X	X		

X* Denotes compatibility of rootstock and soil group
Inter. = Interstem

Amostown fine sandy loam
Bernardston silt loam
Birchwood silt loam
Broadbrook very fine sandy loam
Buckland fine sandy loam
Buxton silt loam
Chilmark sandy loam
Eldridge loamy sand
Elmwood fine sandy loam
Essex fine sandy loam, loamy sand
Hero fine sandy loam, silty subsoil variant
Hinesbury loam sand, gravelly loam sand
Hudson silt loam
Keyport silt loam
Ludlow loam
Marlow loam
Marlow loam, dark subsoil
Mattawan fine sandy loam
Meckesville loam, fine sandy loam
Melrose fine sandy loam
Millis fine sandy loam
Nantucket sandy loam
Ninigret fine sandy loam, silty subsoil variant
Paxton fine sandy loam
Peru loam
Pittstown silt loam, loam
Pollux fine sandy loam
Poquonock loamy sand
Rainbow very fine sandy loam
Rhinebeck silt loam
Scituate fine sandy loam, sandy loam
Shelburne loam
Stockbridge silt loam
Suffield silt loam
Watchaug fine sandy loam
Wethersfield loam
Woodbridge fine sandy loam, sandy loam

Group V—Soils that tend to be wet for short periods of time. Slow drainage but deep rooting possible.
Acton fine sandy loam
Belgrade very fine sandy loam, silt loam
Deerfield loamy fine sand, loamy sand
Ellington fine sandy loam
Hero fine sandy loam
Klej loamy sand
Ninigret fine sandy loam
Pompton sandy loam
Sudbury fine sandy loam
Sutton fine sandy loam
Tisbury fine sandy loam
Winooski very fine sandy loam, high bottom

Group VI—Heavy poorly drained soils with clay or hardpans underneath.
Au Gres loamy sand, loamy fine sand
Cabot fine sandy loam
Enosburg loamy sand

Fredon fine sandy loam
Fredon fine sandy loam, silty subsoil variant
Hadley silt loam, low bottom
Hadley very fine sandy loam, low bottom
Kendaia silt loam
Leicester loam, fine sandy loam, sandy loam
Limerick silt loam, very fine sandy loam
Livingston silty clay loam
Madalin silt loam
Norwell loamy sand
Ondawa fine sandy loam, low bottom
Podunk fine sandy loam
Raynham silt loam, very fine sandy loam
Ridgebury fine sandy loam, loam, sandy loam
Rumney fine sandy loam
Saugatuck sand
Scantic silt loam
Stissing silt loam, loam
Swanton fine sandy loam
Walpole fine sandy loam
Wareham loamy sand
Wilbraham loam
Winooski silt loam, very fine sandy loam, low bottom

Cultivars[6]

Apple cultivars do not grow true to type from seed. They are propagated by means of grafting or budding. Hence, most apple trees consist of two distinct parts: the rootstock and the cultivar.

The proper choice of cultivars will have much to do with the success or failure of the orchard enterprise. Some important points to consider in the choice of cultivars are market demand, succession of ripening periods, productiveness and storage life. Descriptions of cultivars recommended for commercial plantings and trials may be obtained from your County Extension Office.

There are many strains of some cultivars. Strains differ in fruit characteristics or tree characteristics or both. Spur type strains differ from standard trees in that more of the lateral buds on 2 and 3-year-old wood develop into fruit spurs. This causes compactness of the tree. Spur types in comparison to standard types seem to put more sunlight energy into the fruit. Their disadvantages consist of upright growth habit and more limb-rub on fruit and fruit shading by the leaves. Limb spreading is more essential on spur types because of their upright growth habit than on standard types.

[6]A term that is now used in place of the older term, variety, when designating a specific horticultural variation in a plant series.

There are fewer lateral branches produced from the main branches because many lateral buds form fruiting spurs (Fig. 1A and 1B). Thus, branches that are allowed to grow without heading, may develop many short spurs but few laterals. Branches such as this bear early but there is only a small potential fruiting area with few replacement spurs, a condition that can lead to alternate bearing.

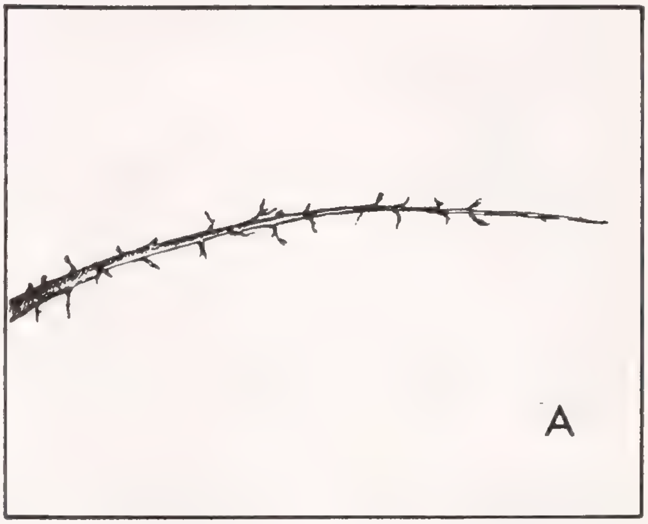


Fig. 1A. Typical branch from a spur-type tree. Note the heavy fruit bud and spur development and lack of side shoots.

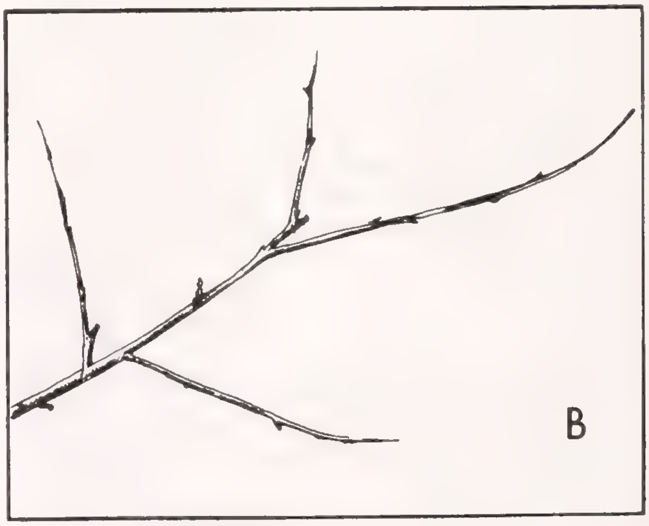


Fig. 1B. Typical branch from a standard type tree (non-spur). This branch shows lateral branch development, but few fruit spurs.

Cooperative Extension Service
University of Massachusetts
Amherst, Massachusetts
R. S. Whaley
Director
Cooperative Agricultural Extension Work
Acts of May 8 and June 30, 1914
—
Official Business
Penalty for Private Use, $300

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF
AGRICULTURE
AGR 101

U.S.MAIL

BULK THIRD CLASS MAIL PERMIT